

KEUFFEL & ESSER CO.

FOUNDED
1867

THE H. H. WEST CO.
MILWAUKEE AGENTS
386 EAST WATER ST.

IMPORTANT NOTICE

Owing to conditions resulting from the war we publish this, the 36th edition of our catalogue, without prices. For the convenience and guidance of our patrons, we attach a list giving current prices on all our merchandise.

Revised price lists will be issued from time to time as necessary, but we recommend that our clients assure themselves in every instance that they are provided with the latest issue of these price lists.

KEUFFEL & ESSER CO.

GENERAL OFFICE & FACTORIES
HOBOKEN N. J.

PARENT HOUSE
NEW YORK, 127 FULTON STREET

BRANCHES

CHICAGO	516-20 S. DEARBORN STREET
ST. LOUIS	817 LOCUST STREET
SAN FRANCISCO	30-34 SECOND STREET
MONTREAL	6 NOTRE DAME ST. W.



CATALOGUE OF

KEUFFEL & ESSER CO.

MANUFACTURERS AND IMPORTERS

DRAWING MATERIALS

SURVEYING INSTRUMENTS

MEASURING TAPES



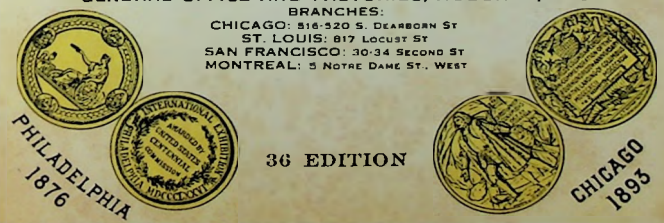
NEW YORK

127 FULTON ST. 42 ANN ST.

GENERAL OFFICE AND FACTORIES, HOBOKEN, N. J.

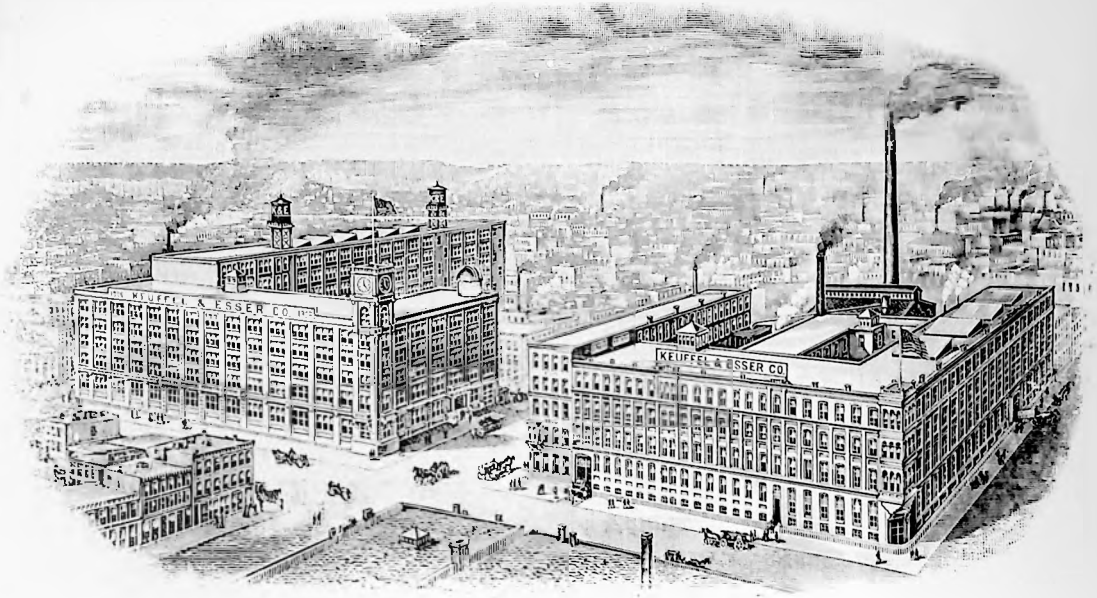
BRANCHES:

CHICAGO: 516-520 S. DEARBORN ST
ST. LOUIS: 817 LOCUST ST
SAN FRANCISCO: 30-34 SECOND ST
MONTREAL: 5 NOTRE DAME ST., WEST

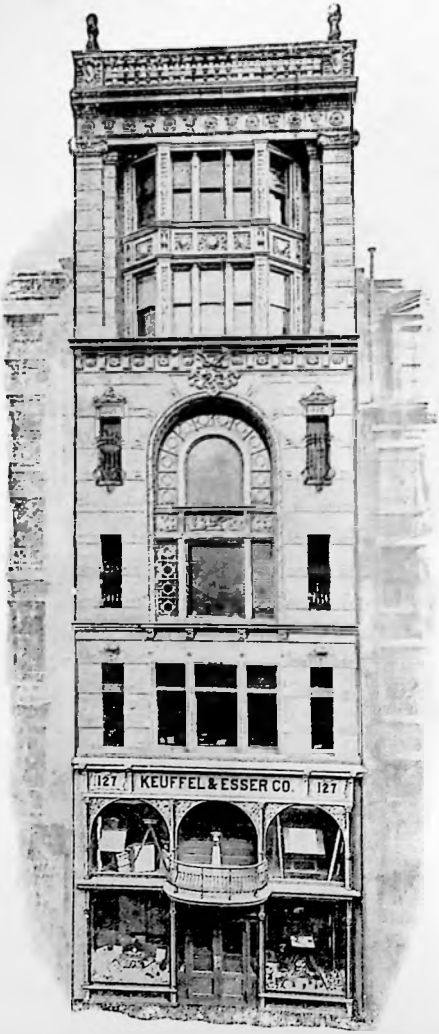


36 EDITION

Copyright 1887 by KEUFFEL & ESSER.
Copyright 1890, 1891, 1892, 1893, 1894, 1895, 1897, 1898, 1899, 1902, 1905, 1909, 1912, 1915, 1921 by
KEUFFEL & ESSER CO.



GENERAL OFFICE AND FACTORIES, HOBOKEN, N. J.
Completed 1907.



PARENT HOUSE, NEW YORK

127 FULTON STREET, EXTENDING TO 42 ANN STREET.


BRANCH HOUSES
CHICAGO
516 - 520 S. DEARBORN ST.
KEUFFEL & ESSER CO.
817
ST. LOUIS
817 LOCUST ST.
K & E BUILDING
KEUFFEL & ESSER CO.
MONTREAL
5 NOTRE DAME ST. W.
SAN FRANCISCO
30-34 SECOND ST.

IMPORTANT NOTICE REGARDING OWNERSHIP OF GOODS IN TRANSIT.

There appears to be a misunderstanding on the part of some buyers in regard to the ownership of goods which are in transit between buyer and seller.

In order to avoid any misunderstanding, we would state, that when goods are sold f. o. b. shipping point the title passes to the consignee, and the consignor's responsibility for delivery or damage ceases as soon as the latter obtains a receipt from the Transportation Company. The goods, therefore, should be paid for in accordance with agreed terms, even though they have not reached their destination; responsibility for their non-delivery rests with the Transportation Companies. Claims against these Companies must be made by the consignee.

When requested we will furnish any necessary documents for making these claims. The Express Companies limit to four months, and the Freight Companies to six months, the period within which claims must be made, and this period dates from the day of shipment. The fact that notice has been given to the Transportation Company that the goods have not been delivered, and that a request has been made to trace them, does not serve to extend the period within which claims for damage or loss may be made.

January, 1921.

To our Patrons:

In submitting this, the 36th edition of our catalogue, we bespeak for it the same kind reception which has been accorded the preceding editions.

This new catalogue presents more changes than usual, largely owing to the consequences of the war, which forced us to manufacture certain goods formerly imported from Europe.

Most important among these are Drawing Instruments, which we now manufacture at our Union Hill, N. J. factory. These instruments have met with such favorable reception on account of their satisfactory design and workmanship, that we feel justly proud of our achievement.

Prices being very unstable on account of constant changes in the labor and material markets, we have decided to publish this catalogue without prices.

List prices pertaining to this catalogue will be published as separate lists from time to time as necessity may demand. Customers having active accounts will be furnished these lists as soon as published; those having no active accounts on our books can obtain lists upon request.

Customers will please assure themselves that they have our latest price list.

Our New York establishment includes the Retail, City Order and Blueprint Departments, which occupy the entire building, thus enabling us to display our goods in the most advantageous manner in a location most convenient to our patrons. We have Branches at **Chicago, St. Louis and San Francisco;** since 1908 we have had a Branch House at **Montreal.** All our Branches carry an ample line of our goods and are equipped with a modern plant for preparing Blueprint and Brownprint papers, so that the stock obtained from them is always fresh and orders can be filled immediately. We have workshops at all our Branches for making minor repairs on our instruments.

Conscious of the standing which more than 50 years of progress and success have given our House, we shall make it our foremost duty to maintain our reputation for the absolute reliability of our goods, as well as for strictest fairness and broad good-will in our dealings with those who favor us with their patronage.

Very respectfully,

KEUFFEL & ESSER CO.

Besides this General Catalogue, we publish separately:—

TRADE PRICE LIST, (supplemental to the general catalogue),
(Instruments for schools, trade grades of drawing tools, etc.)
TRADE PRICE LIST OF MEASURING TAPES (for the Hardware Trade).

NOTICE.

THIS 36th edition of our catalogue supersedes all previous editions.

The prices in the supplemental price list published from time to time are Net Cash in New York, Chicago, St. Louis* and are subject to change without notice. For our Branches at San Francisco, Cal., and Montreal, Canada, we issue a separate price list.

In ordering from this Catalogue, it is necessary to give the number, and in some cases the sub-number, size, color, etc., of material desired.

Remittances can be made either by bank-draft, payable to our order, by Cash sent through any of the Express Companies, or by Post-Office or Express Money-Order. If Cash is sent by mail, the letter should be registered.

Remittances in all cases are at the risk of the sender.

New accounts can be opened only with firms rated in the commercial reference books, unless the order is accompanied by other satisfactory references. We mention this because new industrial enterprises, even when very important, are often not listed in the reference books, which causes much delay in obtaining information.

For special goods to be made to order and not listed by us, we invariably require payment when the order is placed.

For goods ordered to be sent by express, the bill to be collected on delivery, a remittance to cover packing and expressage both ways is required with the order. Express-charges for collection will be added to the amount of the bill.

By sending full remittance with the order, buyers will save the charges for collecting the amount of the bill, and will avoid delay in delivery.

For parcel post shipments, postage at the established rates must be added to the price of goods so ordered. Shipments valued over one dollar are insured at the following rates:

3	cents	for a value up to					$ 5.00	
5	"	"	"	from	$ 5.00	up to	25.00	
10	"	"	"	"	25.00	up to	50.00	
25	"	"	"	"	50.00	up to	100.00,	etc.

Parcel post matter may be sent C. O. D. on payment of a fee of 10 cents for $50.00 or less and of 25 cents for a collection of from $50.00 to $100.00, in addition to the postage. The amount collected from the addressee includes the fee for the post-office money order, by means of which remittance is made. The C. O. D. fee also covers insurance.

As we use every precaution in packing goods, no allowance can be made if goods be damaged in direct shipment or in enclosure, through other houses.

Boxes, which may be required for packing, will be charged at cost.

Should any of our goods not prove satisfactory, we solicit prompt information: any complaints shall have our careful attention, as we aim to satisfy our patrons in every respect, in order to maintain the reputation we are now enjoying.

*The prices of some of the more bulky or heavy goods are slightly higher at our Branches than in New York, on account of the very high transportation charges. Such exceptions are mentioned in this catalogue.

WARNING

It has come to our attention that unscrupulous dealers are offering drawing and tracing papers under names very similar to our trade mark names, for the evident purpose of misleading the purchaser and making possible the fraudulent substitution of goods bearing imitation names.

We wish to warn our customers against practices of this kind and to serve notice that we will vigorously prosecute any infringements of our trade marks, which are fully protected according to law.

Our standard goods bear either one of our two general trade marks ( , K & E) or our name. Goods not bearing these marks are not our goods as listed in this catalogue.

KEUFFEL & ESSER CO. NEW YORK

DRAWING PAPERS

IN SHEETS.

WHATMAN'S HAND-MADE.

Whatman's Drawing Papers, "Selected Best," and "Retree," are made as one quality, and the sheets are afterwards examined and separated at the mill. The sheets without imperfections are called "Selected Best." Both bear either the watermark "WHATMAN" or "WHATMAN TURKEY MILLS."

These papers are made with three different styles of surface:

HP., signifying "Hot Pressed," has a smooth surface; mostly used for pencil and very fine line drawings.

N., signifying "Not Hot Pressed," has a finely grained surface; used for general purposes and water-color drawing.

R., signifying "Rough," (Torchon Paper), has a coarsely grained surface; used for very bold drawing, sketching and water-color drawing.

In ordering please state Catalogue NUMBER, SIZE and SURFACE (HP. N, or R.)

1. Whatman's, with "HP" or "N" surface.

Cap	13 × 17 in.	per quire	$
Demy	15 × 20 "	"	
Medium	17 × 22 "	"	
Royal	19 × 24 "	"	
Super Royal	19 × 27 "	"	
Imperial	22 × 30 "	"	
Atlas	26 × 34 "	"	
Double Elephant	27 × 40 "	"	

1A. Whatman's, with "HP" or "N" surface. **Selected Best.**

Imperial	22 × 30 in.	per quire	$
Atlas	26 × 34 "	"	
Double Elephant	27 × 40 "	"	

2. Whatman's, with "R" surface.

Royal	19 × 24 in.	per quire	$
Imperial	22 × 30 "	"	
Double Elephant	27 × 40 "	"	

3. Whatman's, Extra heavy, with surface as below. **Selected Best only.**

Imperial	22 × 30 in. HP. or N.	per quire	$
Double Elephant	27 × 40 " HP. or N.	"	

For Mounted Whatman's papers, see page 14.

For shipping sheet papers, packed flat, the packing charges are about 10 cents per sq. ft.

KEUFFEL & ESSER CO. NEW YORK



Reduced fac-simile of the label of Universal Paper in Sheets.

4. *Universal* Paper. Each sheet stamped 

For Universal Paper in continuous rolls, see page 10.

Universal Drawing Paper is of pure stock, free from adulterations, of natural white color, finely grained surface and very carefully sized. A perfect, porous, soft, and uniform pencil mark can be produced on it. It takes ink and color well, and its erasing properties are perfect, making it the best and most popular paper for Colleges and Schools. It is also a very good paper for water colors.

The several sizes are of graded thickness. The first three sizes being the thinnest Royal and Imperial being somewhat thicker and Double Elephant being thickest.

Cap	13½ × 17 in.	per ream $	per quire $
Demy	15 × 20 "	"	"
Medium	17 × 22 "	"	"
Royal	19 × 24 "	"	"
Imperial . . .	22 × 30 "	"	"
Double Elephant	27 × 40 "	"	"

Ream prices apply also to ¼ reams Royal and ¼ reams Imperial and Dbl. Elephant.

5. *Normal* Paper. Each sheet stamped 

A drawing paper of very superior quality, of natural white color, with smooth surface for LINE DRAWINGS in ink or pencil. It stands erasing perfectly and is very tough. All sizes are of the same thickness.

We highly recommend this paper for elaborate, or complicated line drawings on account of its hard and smooth surface, and for working drawings on account of its strength and durability. It is used to a great extent in schools where machine drawing is taught.

Royal	19 × 24 in.	per ream $	per quire $
Imperial . . .	22 × 30 "	"	"
Double Royal .	24 × 36 "	"	"
Double Elephant	27 × 40 "	"	"

Ream prices apply also to ½ reams Royal and ¼ reams Imperial, Dbl. Royal and Dbl. Elephant.

7. *Selecta* Paper. Each sheet stamped

For Selecta Paper in continuous rolls, see page 11.

A paper for the most fastidious, pure white, and of hitherto unattained uniformity and firmness of surface, combining practically all the advantages of hand-made paper with the uniformity of the machine made. It is of the very best material and almost homogeneous in texture, although the strength of the fibre has been preserved. Recommended for specially fine drawings. All sizes are of the same thickness.

Royal	19 × 24 in.	per ream $	per quire $
Imperial	22 × 30 "	"	"
Double Royal .	24 × 36 "	"	"
Double Elephant	27 × 40 "	"	"

Ream prices apply also to ½ reams Royal and ¼ reams Imperial, Dbl. Royal and Dbl. Elephant.

8. *Paragon* Paper, pebbled surface, medium. Each sheet stamped 

For Paragon Papers in continuous rolls, see pages 10 to 11.

Paragon Paper No. 8 (No. 71 in rolls) has a sand-grained or pebbled surface (similar to eggshells). It is a natural white drawing paper of very fine quality, excellent for any kind of drawing, pen, pencil or water color, will not turn brittle with age and has erasing qualities which are possible only in a paper of this high grade. We warrant every piece of Paragon paper to fully bear out our recommendation.

The 2 sizes are of the same thickness.

Royal, ...	19 × 24 in.	per quire	$
Imperial	22 × 30 "	"	

10. *Duplex* Paper, medium, cream color. Each sheet stamped

For Duplex Papers in continuous rolls, see page 9.

Duplex Papers are tough and hard, with slight grain, stand erasing very well and take pencil, ink and colors perfectly. Their tint is agreeable to the eye and permits of much handling without soiling. All sizes are of the same thickness.

Royal	19 × 24 in.	per ream $	per quire $
Imperial	22 × 30 "	"	"
Double Royal . . .	24 × 36 "	"	"
Double Elephant . .	27 × 40 "	"	"

Ream prices apply also to ½ reams Royal, and ¼ reams Imperial, Dbl. Royal and Dbl. Elephant.

15. K & E Ledger Paper.

An excellent white ledger paper of heavy weight with smooth surface. The 4 sizes are of the same thickness.

Demy	(16 × 21) in.	per ream $	per quire $
Medium	(18 × 23) "	"	"
Royal	19 × 24 "	"	"
Double Royal . . .	24 × 36 "	"	"

Ream prices apply also to ½ reams Royal, and ¼ reams Dbl. Royal.

15½. K & E Ledger Paper.

Like No. 15 but of lighter weight.

Demy	(16 × 21) in.	per ream $	per quire $
Medium	(18 × 23) "	"	"
Royal	19 × 24 "	"	"
Double Royal . . .	24 × 36 "	"	"

Ream prices apply also to ½ reams Royal, and ¼ reams Dbl. Royal.

16. K & E Bond Paper.

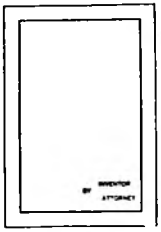
An exceedingly tough paper of light weight, fairly transparent and natural white color; permits of folding (creasing) to nearly any extent, and is, therefore, specially well adapted for maps and drawings which are to be carried in the pocket. The 4 sizes are of the same thickness and have no watermark.

Royal	19 × 24 in.	per ream $	per quire $
Imperial	22 × 30 "	"	"
Double Royal . . .	24 × 36 "	"	"
Double Elephant . .	27 × 40 "	"	"

Ream prices apply also to ½ reams Royal, and ¼ reams Imperial, Dbl. Royal and Dbl. Elephant.

KEUFFEL & ESSER CO., NEW YORK

BRISTOL BOARDS.



Stamped with Trade Mark



BLANK (NOT PRINTED)

Reynolds' Bristol Board, white, smooth surface. Blank, (not printed)

17-2. (2 ply)
17-3. (3 ply)
17-4. (4 ply)

		17-2 (2 ply)	17-3 (3 ply)	17-4 (4 ply)
Patent Office	10 × 15 in. per doz. . .	$		*
Cap	12½ × 15¼ " " . .			
Demy . . .	14⅜ × 18¼ " " . .			
Medium . .	16½ × 20¾ " " . .			
Royal . .	18¼ × 22⅜ " " . .			
Imperial . .	21½ × 28¾ " " . .	*	*	

*Not carried in stock.

PRINTED (WITH BORDER, ETC.)

17P. Reynolds' Bristol Board. Printed (with border, etc.), for U. S. Patent Office drawings. 10 × 15 in., 3 ply, gross, $ doz. $

17PL. do. do. do. 10 × 15 " 2 " " "

WHITE MOUNTING BOARD.

26. White Mounting Board.

	22 × 28 4 ply.	22 × 28 6 ply.	22 × 28 8 ply.	22 × 28 10 ply.	30 × 40 in. 10 ply.
per doz.	$				
per sheet					

Mounting Board must be packed flat for shipment. Packing charges are about 10c. per square foot.

RUBBER CLOTH.

28. Rubber Cloth, black, 36 in. wide . . . . . per yard $

This fabric is pliable and impervious to moisture, so that it makes an excellent cover for the drawing board and a good wrapper for drawings.

BINDING STRIPS.

31. Adhesive Binding Strips (Crowell),
¾ in. wide, 50 feet, in practical paper box . . . . . per box $

Samples sent on application, or general sample book for 15c.
For shipping Bristol Board flat, the packing charges are about 10c. per square foot.

DETAIL PAPERS

IN CONTINUOUS ROLLS.

(For Drawing Papers, see page 9.)

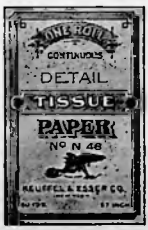
SMOOTH MANILLA PAPERS.

The smooth Manilla papers, intended mainly for stencils and patterns, are occasionally used for detail and preliminary drawings. While we exercise all possible care in their selection, we cannot assume any responsibility for their being suitable for drawing. They are carried in three weights, 40-1 being the lightest and 40-3 the heaviest.

		width in inches,	36	40	48	54
40-1.)	Smooth Manilla, rolls of ab't 100 lbs., per lb.	$				
40-2.						
40-3.)						

		width in inches,	36	40	48	54
40-1X.	Smooth Manilla, 50 yard rolls, per roll,	$				
40-2X.	" " 50 " " " "					
40-3X.	" " 50 " " " "					
40-1XX.	" " 100 " " " "					
40-2XX.	" " 100 " " " "					
40-3XX.	" " 100 " " " "					

DETAIL TISSUE PAPER.



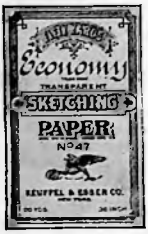
Reduced fac-simile of label of Detail Tissue Paper.

N46. Detail Tissue Paper. 36 in. wide, ... per roll of 50 yards $
42 " " " " " " " "
57 " " " " " " " "

This Paper is not made for strength and will not stand much handling; it is fairly transparent, however, and can be used for rough pencil drawings.

ECONOMY SKETCHING & DRAWING PAPERS

(TRANSPARENT)





Reduced fac-simile of labels of Economy sketching papers.

TRANSPARENT SKETCHING PAPERS.

Economy Sketching Papers are excellent all-around detail papers. They are of natural white color, stand erasing by knife or rubber, take pencil, ink and colors well, and while tough and strong, are sufficiently transparent for coarse tracings, such as details. These many useful qualities, together with their moderate price, make the Economy papers superior detail papers and the best all-around sketching papers. Fair blueprints can be made from them. Each roll water-marked *Economy*

47 L. *Economy* Transparent Sketching Paper, white, light weight.

| | | |

SIMPLEX DETAIL PAPERS.



Reduced fac-simile of label of Simplex Papers.

Simplex Detail Papers are made especially for us by one of the most expert manufacturers and possess drawing paper qualities so far as these are attainable in manilla papers. The surface is slightly grained, rough enough to take the pencil readily and smooth enough for ink work. The color is a shade deeper than that of ordinary manilla paper, making it less liable to appear soiled. Special attention has been paid to the erasing qualities of these papers, and we recommend them as a considerable improvement over the manilla papers ordinarily used.

Each roll water-marked Keuffel & Esser Co., Simplex.

Simplex Detail Paper, Light Weight.

	width in inches,	36	42
48 L.	rolls of about 100 lbs., per lb.	$	
48 LX.	per roll of 50 yards		
48 LXX.	per roll of 100 yards		

Simplex Detail Paper, Medium,

	width in inches,	36	42	48	54
48.	rolls of about 100 lbs., per lb.	$			
48 X.	per roll of 50 yards				
48 XX.	per roll of 100 yards				

Simplex Detail Paper, Heavy.

	width in inches,	36	42	48	54
49.	rolls of about 100 lbs., per lb.	$			
49 X.	per roll of 50 yards				
49 XX.	per roll of 100 yards				

Samples sent on application, or general sample book for 15c.

DRAWING PAPER.

Good drawing paper must combine many different features, and these the buyer should be able to distinguish, to be in a position to discriminate between various kinds, so as to make a selection suitable to the purpose for which he intends to use the paper.

First in importance is the material from which the paper is made, and second the mode of manufacture, both of which become manifest when the finished article is used. Good drawing paper should be strong, of uniform thickness and surface, stretch evenly, and should neither repel nor absorb liquids. It should admit of considerable erasing without detriment to its surface, should not become either brittle or discolored by reasonable exposure and age, and should not wrinkle when stretched or when inks or colors are applied to it.

It is impossible to combine all these features in one paper, so that all may be apparent in their utmost degree of perfection; thus, the greatest strength cannot be combined with the finest surface, as is particularly exemplified in the case of manilla fibre, which, although one of the strongest materials used in the manufacture of paper, cannot be made into *drawing* paper.

The careful draftsman is, therefore, compelled to select that paper which unites to best advantage those qualities which are most adapted to his special requirements. To make a personal selection every time he is in need of paper is generally impracticable. He is, therefore, mostly obliged to rely upon the descriptions of the papers offered him, and then to trust that the one selected will be as described and can be obtained again in the same quality at any future time.

Each one of the papers listed in this catalogue possesses certain special and distinctive features of its own, which are set forth accurately and with a view to enable the buyer to make a selection satisfying his wants. **Every one of our papers is made solely and specially for us, and can in no case be procured except from us, or from dealers who purchase their supply from us.** The qualities and distinctive features of each paper are strictly maintained and successive orders can be given with the assurance that the same article will invariably be furnished.

The following assortment has been made after careful study of the draftsman's wants, based on more than fifty years' experience, and we believe it will be found to meet all requirements. It has been made comprehensive enough to answer all purposes, but no more so, in order that selection may be facilitated. No two of these papers possess all the same features, nor are different designations and descriptions applied to the same paper, with a view to make an apparent increase in the assortment. Each paper has its own characteristics and will be found satisfactory, if selected with due regard to its special qualities.

The good results of such a policy are manifested by the reputation gained by our

Paragon, Duplex, Universal, Anvil, Normal

and other papers, the trade marks of which are looked upon by draftsmen all over the country as standards of excellence.

In consequence of this a good many imitations, especially of PARAGON, UNIVERSAL and DUPLEX papers have been put on the market; they are offered under similar names and are palmed off as identical with our papers.

The Helios and Parchmine Papers listed on page 21, although specially made for blueprinting, are also good drawing papers and are very often used as such. They take ink, pencil and water colors and have good erasing qualities.

DRAWING PAPERS
IN CONTINUOUS ROLLS.



Reduced fac-similes of labels of some of our Drawing Papers.

50. *Duplex* A Detail Drawing Paper, which stands in a class by itself and is now so well known that it hardly requires description. It is excellent for any kind of drawing. The cream or buff color is agreeable to the eye and permits of handling without soiling.

No. 10 (on page 3) are the same papers in sheets.

Each roll water-marked *Duplex*.

50. *Duplex* medium, cream color.

width in inches . .	30	36	42	56	62
rolls 35 to 40 pounds, per lb. . .	$				
per 50 yard roll . .					
per 10 yard roll . .					
per yard					

55. *Universal* A natural white paper of good quality, with slightly grained surface, suitable for work in ink, color, pencil or crayon. It is used for general office work, and on account of its price for preliminary drawings also. It is in use in Technical Schools and Universities probably to a greater extent than all other Drawing Papers.

No. 4 is the same paper in sheets, but of graded thickness.

Each roll water-marked *Universal*

55. *Universal*, medium.

width in inches,	36	42	56	62
rolls 35 to 40 pounds, per pound,	$			
per 10 yard piece,				
per yard,				

60. *Anvil* A very tough and hard natural white paper, matchless for working-drawings used out-of-doors or in the workshop, where drawings are subject to rough handling. This paper has a slightly grained surface, similar to Whatman's "Not" and stands erasing to the greatest extent.

Each roll water-marked *Anvil*

60. *Anvil*, medium.

width in inches,	36	42	62
rolls 35 to 40 pounds, per pound,	$		
per 10 yard piece,			
per yard,			

Paragon papers No. 71—76 are so well and favorably known, that there is but little to say about them; their excellence is universally acknowledged.

We warrant Paragon Papers and exchange any which do not give perfect satisfaction.

Paragon Papers are of natural white color and are highly recommended for elevations, perspectives, maps and most kinds of finished drawings.

We list Paragon paper No. 71 in sheets under No. 8, page 8.

Each roll water-marked *Paragon*.

Nos. 71 and 72 have a sand-grain or pebbled surface (similar to eggshells) adapted for general drawings, either in line or in wash.

71. *Paragon*, pebbled surface, medium, width in inches 36 42 56

rolls 35 to 40 pounds, per pound $

per 10 yard piece . . . .

per yard . . . . . .

Samples sent on application, or general sample book for 15c.

72. *Paragon*, pebbled surface, thick . . . . . width in inches 58
rolls 35 to 40 pounds, per pound . . . . . $
per 10 yard piece . . . . . .
per yard . . . . . .

75. *Paragon*, finely grained surface, medium,
width in inches 36 42 58 72
rolls 35 to 40 pounds, per pound. $
per 10 yard piece
per yard . . . .

76. *Paragon*, finely grained surface, thick. . . width in inches 58 72
rolls 35 to 40 pounds, per pound . . . . $
per 10 yard piece . . . . .
per yard . . . . . .



Reduced fac-simile of label of Selecta Paper.

Selecta paper is the nearest approach to hand-made paper ever attained in a roll paper. It combines practically all the advantages of hand-made with the uniformity of machine-made paper. It is of the very best material obtainable and no expense has been spared to make it the best paper that can be produced. It is nearly homogeneous in texture, although the strength of the fibre is fully preserved; this gives it a surface of hitherto unattained uniformity and firmness, equally well adapted to pencil, ink and colors and of excellent erasing quality. We recommend this paper for competitive drawings, fine maps, engrossing, etc. No. 7 (page 2) is the same paper in sheets.

Each roll water-marked *Selecta*

80. *Selecta*, medium thick. . . . . width in inches 58
rolls 35 to 40 pounds, per pound . . . . . $
per 10 yard piece . . . . . .
per yard . . . . . .

MOUNTED DRAWING PAPERS.

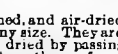
MOUNTED ON MUSLIN, IN ROLLS OF 10, 20, 30 OR 40 YARDS.

We list mounted papers in 10-yard rolls, but also can furnish, at a slight additional advance per yard, any of our mounted papers in 20, 30, or 40 yard rolls, in all widths.



Reduced fac-similes of labels of some of our mounted papers.

Our papers are mounted, stretched, and air-dried. This refers also to 20, 30 and 40 yard rolls and to papers in sheets of any size. They are much superior to papers mounted by compression between rollers and dried by passing over heated rollers. The rollers distort and strain the paper and destroy the surface, while drying by heat injures the paper and the adhesive.



To protect our customers against faulty mounting or mounting on inferior muslin, we stamp the muslin side of our papers, when mounted by us, with their trade-mark name and "Keuffel & Esser Co —Mounted Paper" as shown above.

100.	*Universal*	No 100 is No. 55 Mounted. For description, see page 10.				
		36 in. wide, per 10 yard roll	$		per yard	$
	do.	42 "	"		"	
	do.	56 "	"		"	
	do.	62 "	"		"	
103.	*Duplex*	No. 103 is No. 50 mounted. For description, see page 9.				
		36 in. wide, per 10 yard roll	$		per yard	$
	do.	42 "	"		"	
	do.	56 "	"		"	
	do.	62 "	"		"	
105.	*Anvil*	No. 105 is No. 60 mounted. For description, see page 10.				
		36 in. wide per 10 yard roll,	$		per yard	$
	do.	42 "	"		"	
	do.	62 "	"		"	

Samples sent on application, or general sample Book for 15c.

MOUNTED DRAWING PAPERS.

MOUNTED ON MUSLIN, IN ROLLS.

(CONTINUED.)

Nos. 111, 112, 115, 116, are
Nos. 71, 72, 75, 76, mounted.
For description, see pages 10 and 11.

111.	*Paragon*	36 in. wide, per 10 yard roll $			per yard $
	do.	42	"	"	"
	do.	58	"	"	"
112.	do.	58	"	"	"
115.	do.	36	"	"	"
	do.	42	"	"	"
	do.	58	"	"	"
	do.	72	"	"	"
116.	do.	58	"	"	"



No. 118 is No. 80 mounted. For description, see page 11.

118. *Selecta* 58 in. wide, per 10 yard roll $ per yard $

FOR MOUNTED PAPERS IN SHEETS, SEE NEXT PAGE.

Samples sent on application, or general sample book for 15c.

MOUNTED DRAWING PAPERS

IN SHEETS. MOUNTED ON MUSLIN.

125. Unchangeable Drawing Board

This Board consists of double mounted Paragon paper on the one side and Simplex paper on the reverse side, cross-grained, the Simplex side being specially treated. It forms a flat and hard board which is very resistant to changes in atmospheric conditions.

The drawing surface is Paragon drawing paper No. 71 (pebbled surface), unless No. 75 (finely grained) is ordered.

Royal	19 × 24 in.	per sheet	$
Imperial	22 × 30 "	"	
Double Elephant.	27 × 40 "	"	

Intermediate and larger sizes furnished to order.

130. Whatman's Drawing Paper, mounted.

Royal	19 × 24 in.,	Selected Best	per sheet	$
Imperial	22 × 30 "	"	"	
Double Elephant.	27 × 40 "	"	"	

135. Paragon Drawing Paper, in sheets, mounted.

Mounted Paragon Papers in sheets Nos. 135 and 137 are made of paper No. 71 (pebbled surface), unless No. 75 (finely grained) is ordered.

Royal	19 × 24 in.	per sheet	$
Imperial	22 × 30 "	"	
Double Elephant.	27 × 40 "	"	
Antiquarian . . .	31 × 53 "	"	

137. Paragon Drawing paper in sheets, like No. 135 but MOUNTED ON BOTH SIDES of the muslin ("muslin between") for record books, etc.

Royal	19 × 24 in.	per sheet	$
Imperial	22 × 30 "	"	
Double Elephant.	27 × 40 "	"	
Antiquarian . . .	31 × 53 "	"	

MOUNTED SHEETS TO ORDER

The prices for mounted papers in sheets, except Whatman's papers, are for muslin trimmed to the size of the sheet. If the muslin on Paragon papers be wanted larger than the paper, on one or more edges, this must be explained in the order. Mounting on larger muslin slightly increases the price of the mounted sheet.

Mounted sheets of other sizes than listed above will be furnished to order. We can also furnish to order sheets mounted on both sides of the muslin, with the direction of the grain of the two sheets crossing.

EXTRA LARGE SHEETS

for city, county, mine, etc., maps mounted to order. These are built up of two or more widths of paper. The joining edges are accurately beveled by a special machine and overlapped, producing a hardly perceptible and very durable seam. Our facilities in this line are unequalled; we have furnished perfect sheets as large as 50× 30 feet, which were highly satisfactory and proved durable in use. Prices on application.

Samples sent on application, or general sample book for 15c.
For shipping sheet papers flat, the packing charges are about 10 cents per square foot.

KEUFFEL & ESSER CO.

General Office and Factories, HOBOKEN, N. J.

Specifications for
PRINTED SHEETS
of Tracing Cloth, Drawing or Tracing Papers.

Please read all questions and answer all that apply to the sheets wanted.

Number of sheets wanted.....

Kind of cloth or paper wanted.....
(State K & E Co. Catalogue number if possible)

Size of sheets over all: F=.....inches; G=.....inches

Margin: A_1=..... A_2=..... A_3=..... A_4=.....
A_1 to A_4 should not be less than $\frac{3}{8}$" on either side
B_1=..... B_2=..... B_3=..... B_4=.....

Dimensions inside of border lines: D=.....inches; E=.....inches

Thickness of border or trimming line: L=No.....; M=No.....
(See other side)

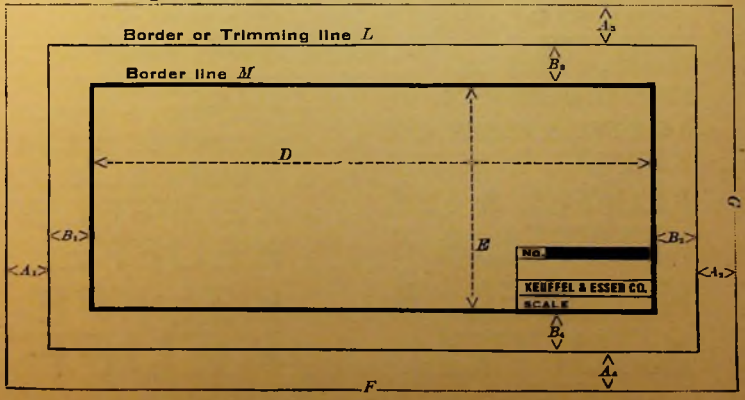
Title: Indicate on form below where imprint of title should be placed. Also state dimensions and number of type desired. If type different from that on other side is to be used, submit sketch with complete specifications.

Borderlines and Title: to be printed on.....side of cloth, with.....type
(Dull or Glazed) (Regular or Reversed)

Sheets are imprinted with reversed type when the imprint is to be placed on the reverse side from that which is to be used as the drawing surface.

If sheets are to be perforated, indicate on form below the location of holes and submit sketch showing exact spacing and size of holes.

Caution: Owing to shrinkage, blueprints are often not exact copies of tracings, hence it is advisable to give exact dimensions as required.



Blanks for ordering Printed Sheets. ADDITIONAL BLANKS WILL BE FURNISHED ON REQUEST.

STANDARD SIZES OF BORDER OR TRIMMING LINES

No. 1.
No. 2.
No. 3.
No. 4.
No. 5.
No. 6.

STANDARD SIZES OF RULING

8 Point

9 Point

12 Point

14 Point

15 Point

18 Point

STANDARD SIZES OF TYPES

No. 1 KEUFFEL & ESSER CO.
No. 2 KEUFFEL & ESSER CO.
No. 3 KEUFFEL & ESSER CO.
No. 4 KEUFFEL & ESSER CO.
No. 5 KEUFFEL & ESSER CO.
No. 6 KEUFFEL & ESSER
No. 7 KEUFFEL & ESS
No. 8 KEUFFEL & E
No. 9 KEUFFEL &
No. 10 KEUFFEL
No. 11 KEUFFEL & ESSER CO.
No. 12 KEUFFEL & ESSER CO.
No. 13 KEUFFEL & ESSER CO.
No. 14 KEUFFEL & ESSER CO
No. 15 KEUFFEL & ESSER
No. 16 KEUFFEL & ESS
No. 17 KEUFFEL & E
No. 18 KEUFFEL &
No. 19 KEUFFEL
No. 20 KEUFFE
No. 21 KEUFF

TRACING CLOTHS (VELLUM).

EXCELSIOR.

The Excelsior Tracing Cloth is far superior to any other, extremely transparent, and very uniform. It is, therefore, particularly well adapted for tracing faint or intricate drawings, and cannot be surpassed for tracings which are intended for copying, by the blue, black or brown-printing process.

150. Excelsior, in rolls of 24 yards, one side glazed, the other dull.

30 36 42 in. wide

per roll $
per yard



No. 156.

IMPERIAL.

156. Imperial, in rolls of 24 yards, one side glazed, the other dull.

24 30 36 38 42 48 54 in. wide

per roll $
per yard

VENUS.

157. Venus, in rolls of 24 yards, one side glazed, the other dull.

30 36 42 in. wide

per roll $
per yard

ALBANENE.

168. Albanene Pencil Cloth, in rolls of 24 yards;

30 38 in. wide

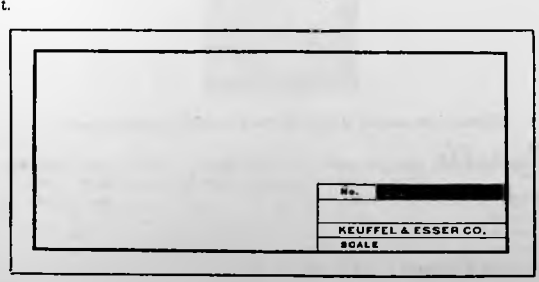
per roll $

This Cloth is in a class of its own, as it is particularly suitable for pencil tracings. One surface has a dull finish, and the texture of the cloth is such that this surface will take the pencil readily, especially with pencils of the medium and soft grades. Excellent blue-prints can be made from pencil tracings on this cloth.

Samples sent on application, or general sample book for 15c.

TRACING CLOTHS IN SHEETS.

We furnish Tracing Cloths in sheets, up to 41 x 59 inches, with border lines, titles, diagrams, etc., printed absolutely opaque and indelible, so that they will blueprint like the drawing. Prices, according to specifications, on request.



Specification form indicating details required, sent on application.



No. 166.



No. 3016.

POUNCE.

166. Pounce for Tracing Cloth, in tin shakers . . . . . each $

When cloth will not take ink readily, dust on a small quantity of the pounce and rub it in evenly with a soft fabric until the cloth has lost its excessive gloss. The pounce must be thoroughly removed before applying the ink.

INKOFF.

3016. INKOFF (Patented). Draftsman's Outfit, including: one bottle of Inkoff, an assortment of Blotters for absorbing, Cloths for wiping the ink from the Tracing Cloth, and Directions for use . . . . . per outfit $

TRACING PAPERS

Prepared papers are specially treated to increase their transparency. Papers "not prepared" are in their natural condition. They will not become discolored nor brittle with age.



Reduced fac-simile of label of our Vegetable tracing papers.

170. *Vegetable*, (not prepared) smooth, natural color, especially thin, very tough and transparent, for Lithographers' work.

Cap	13 × 17 in.	per quire	$
Demy	16 × 20 "	"	
Royal	19 × 25 "	"	
Imperial	22 × 28 "	"	
Double Elephant.	29 × 42 "	"	

TRACING PAPERS.





Reduced fac-similes of labels of our tracing papers.

190. *Parchment* (not prepared), medium, very tough.
39 in. wide, in rolls of 20 yards . . . . . per roll $

191. *Parchment* (not prepared), thick, very tough.
39 in. wide, in rolls of 20 yards . . . . . "

192. *Nacus*, (prepared), smooth, bluewhite, very thin and transparent.
42 in. wide, in rolls of 10 yards . . . . . "

COLONNA, smooth surface, bluewhite, very tough and transparent, are excellent tracing papers, which can often be substituted for tracing cloth (vellum). They make fine photo prints.

N 194. *Colonna* (prepared), thin, smooth surface.
N 194 is old No. 195 T. 30 36 42 in. wide,
per roll of 20 yards $

In sheets	Royal	19 × 24 in.	per quire $
	Imperial	22 × 30 "	"
	Dbl. Royal	24 × 36 "	"

N 195. *Colonna* (prepared), medium, smooth surface.
N 195 is old No. 195 M. 30 36 42 in. wide,
per roll of 20 yards $

In sheets	Royal	19 × 24 in.	per quire $
	Imperial	22 × 30 "	"
	Dbl. Royal	24 × 36 "	"

Samples sent on application, or general sample book for 15c.

KEUFFEL & ESSER CO. NEW YORK

TRACING PAPERS.—Continued.



Reduced fac-similes of labels of our tracing papers.



IONIC, pencil surface, ivory tint, very tough and transparent, an excellent tracing paper which can often be substituted for tracing cloth (vellum).

N196. *Ionic*, (prepared), thin, pencil surface.
N 196 is old No. 197 T. 30 36 42 in. wide,
per roll of 20 yards $
In sheets Royal 19 × 24 in. . . . . per quire $
Imperial 22 × 30 " . . . . . "
Dbl. Royal 24 × 36 " . . . . . "

N197. *Ionic*, (prepared), medium, pencil surface.
N 197 is old No. 197 M. 30 36 42 in. wide,
per roll of 20 yards $
In sheets Royal 19 × 24 in. . . . . per quire $
Imperial 22 × 30 " . . . . . "
Dbl. Royal 24 × 36 " . . . . . "

200. *Doric*, (prepared), smooth, bluewhite, very thin.
42 in. wide, in rolls of 20 yards . . . . . per roll $

201. *Ecco*, (not prepared), pencil surface, white, medium.
36 42 60 in. wide
per roll of 50 yards $

201 L. *Ecco*, (not prepared), pencil surface, white, thin.
36 42 60 in. wide
per roll of 50 yards $

Alva, (not prepared), pencil surface, white, very thin, for transferring. 42 57 in. wide,
202. rolls of 20 yards . . . . . per roll $
202 X. " " 50 " . . . . . "

204. *Lotus*, (not prepared), smooth surface, transparent, tough, thin.
42 in. wide, in rolls of 20 yards . . . . . per roll $
In sheets, Double Elephant 27 × 40 in., ... per quire
formerly carried in sheets under brand Ceres No. 180.

206. *Livia*, (not prepared), like No. 204 but medium thick.
42 in. wide, in rolls of 20 yards . . . . . per roll $
In sheets, Royal 19 × 24 in, ... per quire
do. Double Elephant 27 × 40 " . . . . . "
formerly carried in sheets under brand Corona No. 182.

208. BANKNOTE, (not prepared), smooth surface, thin. 36 42 in. wide,
per roll of 20 yards $

PHOTO PRINTING.

There are three different processes in general use for copying drawings by means of light, namely:

Blue print Process, negative, white lines on blue background,
Black print Process, positive, black lines on white background and
Maduro Process, negative, white lines on black-brown background.

Maduro prints on thin paper can be used (in place of tracings) as negatives for printing, when they will make positive prints (lines on white background) on negative paper. When many prints are to be made from one tracing, the use of negative Maduro prints will save time and avoid wear of the tracing.

Other processes are either too complicated in their manipulation, or uncertain in result, or they necessitate a darkroom and other appliances forbidding their general use.

The results obtained by the above processes depend upon the careful selection and application of the chemicals, and essentially, upon the quality of the paper employed. It has, therefore, always been our endeavor to maintain the high quality of our papers and to improve our formula for coating them, so as thus to produce papers best adapted for their specific purposes. The reputation which our several brands of photo-printing paper enjoy, proves that our efforts have been successful, and that our papers may be depended upon for the work for which we recommend them.

For use in the Tropics we furnish our Photo-printing Papers packed in zinc-lined cases, or, if wanted, each roll in tin tubes, hermetically sealed. Prices on request.

We can furnish our prepared papers also in sheets, if ordered in reasonably large quantities, but we do not list sizes as they are cut to order only.

Please note, that each roll of our Photo-printing Papers bears a serial number along the edge of the label. Should the results obtained with any of our papers not be quite satisfactory, our customers are requested to send us a sample print together with a piece of unexposed paper, protected from light and moisture and ROLLED, (not creased or folded); also that part of the label which bears the SERIAL NUMBER of the roll. This will enable us to ascertain where the fault lies and to explain or correct the trouble.

Our book "Photo-Printing from Tracings," giving full directions, will be mailed free on application.

PRINTING FOR THE TRADE.

We have plants fully equipped with the most advanced appliances for sunlight and electric light printing, in charge of expert printers, at our establishments:

Hoboken, New York, Chicago,
St. Louis, San Francisco, Montreal.

Orders for printing, large or small, will have our careful attention. Tracings called for and prints delivered in the above cities.

PRINTING SPEED
OF BLUEPRINT PAPERS

IMPORTANT NOTICE!

To insure the best results from blueprint papers and cloths, the order should state the desired speed, and whether they are intended for sunlight or electric light exposure or for use in an electric printing machine.

Our blueprint papers are furnished as follows:

Regular, requiring from 4 to 8 minutes exposure in bright sunlight. This will be found the most satisfactory in keeping qualities and in regard to appearance of prints.

Quick, intended for use where prints are required quickly, or where no good light is available. Quick papers require more careful protection from light and dampness before exposure, than the Regular speed.

Electric Quick, for use with electric light, in electric printing machines.

When blueprint paper is required for printing from negatives (blue lines on white ground) we request that this be stated in the order.

We can furnish also paper of other speeds to meet unusual conditions, but in such cases the exact conditions should be explained in the order, to obtain the best possible results.

TRANSLUX.

(Makes negatives more transparent.)

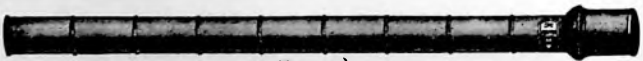


No. 218.

218C. Translux in Tins, one quarter pint . . . . . each $
218F. do. do. " quart, ... "
218H. do. do. " half gallon, ... "
218G. do. do. " gallon, ... "

Translux, a liquid applied to drawings, brownprint negatives, old opaque tracings etc. makes them translucent and thereby saves time in exposing, thus reducing the consumption of current where electric light is used. Prints may be taken direct from regular drawings when **Translux** is used. **Translux** will injure neither print nor drawing.

TUBES FOR STORING PREPARED PAPER.



No. 219)

These tubes are of tin, with well fitting covers, and are the best and most practical receptacles for storing cut rolls of prepared paper, because they exclude both light and moisture. They are well adapted also for storing tracings, plans, drawings, etc.

		for 24	30	36	42	in.
	Tubes for Storing Paper,					
219.	for 10 yard rolls, each $					
	No. 219 has screw cap.					
219X.	for 50 yard rolls, each $					
	No. 219X has pull off cover.					

HELIOS BLUEPRINT PAPERS.



Reduced fac-simile of label of prepared Helios Paper.

Helios Paper. the first Blueprint Paper introduced by us, is still acknowledged to be the best and most reliable. For fine blueprints, it has no equal.

Helios Paper, **prepared**, medium,

		30	36	42	54* in. wide,
220.	per roll of 10 yards	$			
220X.	" " " 50 "				

*The 54 inch width is prepared to order only.

PARCHMINE BLUEPRINT PAPERS.



Reduced fac-simile of label of prepared Parchmine Paper.

Parchmine Papers are fine blueprint papers, which will often be found useful on account of their great strength and toughness which adapt them for prints intended to be filed for record or to stand much handling.

PARCHMINE PAPER, **prepared**, medium,

		30	36	42	54* in. wide,
222.	per roll of 10 yards	$			
222X.	" 50 "				

*The 54 inch width is prepared to order only.

Sample prints sent on application.

COLUMBIA BLUEPRINT PAPERS.





Reduced fac-simile of labels of prepared E. T. and Columbia Papers.

Columbia Papers are intended for the more general employment of blueprints, where the price is a consideration, as for distribution, proposals, etc. They compare favorably with the papers generally put on the market as "First-class blueprint paper."

COLUMBIA PAPER, prepared, thin,

		24	30	36	42	
224 L.	per roll of 10 yards	$				in. wide,
224 LX.	" 50 "					

COLUMBIA PAPER, prepared, medium,

		24	30	36	42	54*	
224.	per roll of 10 yards	$					in. wide,
224 X.	" 50 "						

COLUMBIA PAPER, prepared, thick,

		30	36	42	54*	
224 H.	per roll of 10 yards	$				in. wide.
224 HX.	" 50 "					

*The 54 in. width is prepared to order only.
224 H is old No. 224½; 224 HX is old No. 224½ X.

E. T. BLUEPRINT PAPER. (Mailing Weight.)

E. T. Paper is of the highest quality, very thin and tough and is intended for prints for mailing, saving postage by its light weight.

E. T. Paper, prepared, (extra thin, mailing weight),

		30	36	42	54*	
225.	per roll of 10 yards	$				in. wide,
225X.	" " " 50 "					

*The 54 in. width is prepared to order only.

We can furnish our prepared papers also in sheets, if ordered in reasonably large quantities, but we do not list sizes, as they are cut to order.

Sample Prints sent on application.

For unprepared papers, see pages 16, 17 & 18.

COLUMBIA BLUEPRINT CLOTHS.



Reduced fac-simile of label of Columbia Blueprint Cloth.

Columbia Blueprint Cloth on account of its strength is preferred for prints intended for rough handling, especially in out-door work.

COLUMBIA CLOTH, prepared, thin,

		30	36	42	in. wide,
228L.	per roll of 10 yards	$			
228LX.	" " 50 "				

COLUMBIA CLOTH, prepared, medium,

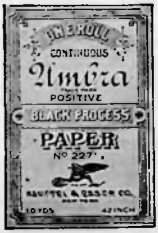
		30	36	42	54* in. wide,
228.	per roll of 10 yards	$			
228X.	" " 50 "				

*The 54 in. width is prepared to order only.

For Unsensitized Columbia Cloths, see page 25.

BLACK PROCESS PAPERS.

(Require water bath only.)



Reduced fac-simile of label of Umbra Paper.

The Umbra is a positive paper, giving an exact fac-simile of the original drawing in clear Black lines on a white ground. As the prints are positive, they do not reverse light and shading as is the case with a blueprint. Umbra prints can be colored, shaded, altered, etc., just like an original drawing.

The Umbra Paper requires no chemical bath, but is developed in a waterbath, like blueprint paper.

Umbra Black Process Paper, prepared,

		30	36	in. wide,
226.	thin, per roll of 10 yards	$		
226 is old No. 227½T.				
		30	36	42 in. wide,
227.	medium, per roll of 10 yards	$		
227 is old No. 227½.				

Write for circular on Umbra Paper.
Sample prints sent on application.

MADURO PAPERS AND CLOTHS.

Negative Prints: White Lines on Black-Brown background.
Positive Prints: Black-Brown lines on White background.
(Maduro Prints serve also as Negatives for making Positive Prints.)



Reduced fac-similes of labels of Maduro Paper and Cloth.



Maduro Paper and **Cloth** give a negative, white-line copy of the original on black-brown background. As this background is impervious to light, these prints (when made on THIN MADURO PAPER or CLOTH), can be used as negatives from which any number of POSITIVE PRINTS of the original can be taken. When many prints are to be made from one tracing, a number of Maduro prints on thin paper can be made, and used as negatives to make many positive prints simultaneously and without risk of damaging or wearing the original tracing. To save making new drawings when corrections or alterations of tracings are necessary, a negative of the tracing should be made on thin Maduro Paper and from this a positive print made on thin Maduro Paper, with the portion to be altered or corrected blanked out by inserting opaque paper between the negative and the positive print which is being made. The corrections can then be drawn in with ink and the amended positive print used the same as a tracing.

BLUEPRINTS OR MADURO PRINTS FROM A (NEGATIVE) MADURO PRINT ON THIN PAPER OR CLOTH, WILL BE FAC-SIMILES OF THE ORIGINAL DRAWING OR TRACING, i. e. BLUE OR BLACK-BROWN LINES ON A WHITE BACKGROUND.

A box of Fixing Salt, 229 S., and directions furnished with each roll.

Maduro **Paper, prepared, very thin, (also for negatives).**

	30	36	42	54* in. wide,
229 T. per roll of 10 yards $				
229 TX. " " 50 "				

Maduro **Paper, prepared, medium,** 30 36 42 54* in. wide,
229 M. per roll of 10 yards $
229 MX. " " 50 "

*The 54 in. width is prepared to order only.

Maduro **Cloth, prepared, thin,** 30 36 42 in. wide,
229 CL. per roll of 10 yards $
229 CLX. " " 50 "

Maduro **Cloth, prepared, medium,** 30 36 42 54* in. wide,
229 C. per roll of 10 yards $
229 CX. " " 50 "

Maduro Cloth, like Columbia Cloth, is very strong and tough, and adapted for prints for out-door use or rough handling.

*The 54 in. width is prepared to order only.

Maduro **Fixing Salt,** 4 8 16 oz. box.
229 S. . . . . . per box, $

Sample Prints sent on application.

UNSENSITIZED (NOT COATED) B. P. PAPERS AND CLOTH

FREQUENTLY USED FOR DRAWING PURPOSES.





230. *Solios* Paper, unsensitized, medium.
30 36 42 54 in. wide,
per roll of 50 yards . $

235. *E.E.* Paper, unsensitized, very thin and tough, mailing weight.
30 36 42 54 in. wide,
per roll of 50 yards . $

232. PARCHMINE PAPER, unsensitized, medium.
30 36 42 54 in. wide,
per roll of 50 yards . . . . $

234. COLUMBIA PAPER, unsensitized, medium.
24 30 36 42 54 in. wide,
per roll of 50 yards $

234 L. COLUMBIA PAPER, unsensitized, thin.
24 30 36 42 in. wide,
per roll of 50 yards . $

234 H. COLUMBIA PAPER, unsensitized, thick.
30 36 42 54 in. wide,
per roll of 50 yards $
234 H is old No. 234½.

238. COLUMBIA CLOTH, unsensitized, medium.
30 36 42 54 in. wide,
per roll of 10 yards . . . . $

238 L. BLUEPRINT CLOTH, unsensitized, thin.
30 36 42 in. wide,
per roll of 10 yards $

Samples sent on application, or general sample book for 15c.

For No. 168, Albanene Pencil Tracing Cloth, see page 15.
For sensitized (prepared) papers and cloths, see pages 21 to 23.



ERASING FLUIDS AND CRAYONS

for making Alterations and Additions on Prints

240 W. HELIOS Erasing Fluid, for Blueprints, white, per bottle $

240 R. do. do. red, " "

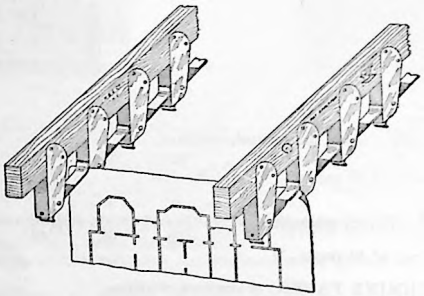
240 Y. do. do. yellow, " "

240 M. MADURO Erasing Fluid, for Maduro prints, white, " "

243. WHITE CRAYON,* for marking on blue prints . . . . . per doz. $

K & E AUTOMATIC PRINT HANGER.

Patented.



249-4. K & E Automatic Print Hanger, bar with 10 holders, each bar $

249-5. " " " " " " 20 " " "

249-6. " " " " " " 25 " " "

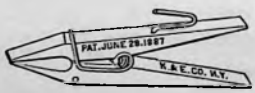
249-7. " " " " " " 30 " " "

249-8. " " " " " " 35 " " "

We quote single bars, as it depends upon the size of the print whether it requires 1 or 2 or more bars to prevent sagging of the wet print between the points of suspension.

This automatic hanger for blueprints, etc., economizes space, saves much time and labor in drying prints, prevents their crumpling, and will not tear the paper. The metal holders are attached to a wooden bar, each holder having a loosely jointed tongue. When a print is inserted it raises the tongue which, dropping back firmly locks the print. To remove the print, the tongue is raised by extending one finger under it. The metal holders are about 2½ inches apart, giving ample circulation of air between the suspended prints.

SPRING CLIPS.



No. 249-3.

249-3. Spring clips, for clamping prints when drying . . . . . doz. $

*For other white pencils for marking on blueprints, see heading "Pencils."

STANDARD
(TRADE MARK)
PROFILE AND CROSS SECTION PAPERS AND CLOTHS.

In sheets and in continuous rolls.
Please order by number.



Reduced fac-similes of labels of Profile Papers.



We call attention to the quality of the paper—a fine tough drawing paper—which we use for our "Standard" Profile and Cross Section Papers. Standard Profile and Cross Section Cloths are recommended in preference to mounted Profile paper for outdoor use, as they will stand much rough handling and suffer less in unfavorable weather.



Plate A, 4 × 20 to the inch.

			SHEETS.				sheet
250G.	green,	engraving	15×42 in.,	Drawing Paper	quire	$	$
250R.	orange	"	15×42 "	do. do.	"		
			CONTINUOUS.				yard
253G.	green,	engraving	20 in. wide,	Drawing Paper . .	50 y'd roll	$	$
253R.	orange	"	20 " "	do. do. . .	50 " "		
254G.	green	"	10 " "	do. do. . .	50 " "		
254R.	orange	"	10 " "	do. do. . .	50 " "		
255G.	green	"	20 " "	mounted on muslin,	20 " "		
255R.	orange	"	20 " "	do. do.	20 " "		
257R.	orange	"	20 " "	Tracing Paper, . .	50 " "		
257½R.	orange	"	10 " "	do. do. . .	50 " "		
258R.	orange	"	20 " "	Tracing Cloth, . .	20 " "		
258½R.	orange	"	10 " "	do. do. . .	20 " "		
259G.	green	"	20 " "	Columbia Cloth, . .	20 " "		
259R.	orange	"	20 " "	do. do.	20 " "		

All "Standard" Profile Papers and Cloths bear this trade mark along the margin.

"STANDARD" PROFILE PAPERS AND CLOTHS.

(TRADE MARK)

In sheets and in continuous rolls.

Please order by number.

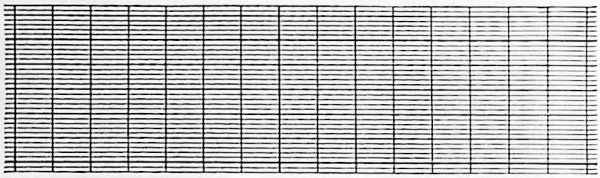


Plate B, 4 × 30 to the inch.

SHEETS.

260G.	green, engraving	13½×42 in.,	Drawing Paper,	quire $		sheet $	
260R.	orange "	13½×42 "	do.	do.	"	"	

CONTINUOUS.

							yard
263G.	green, engraving	20 in. wide,	Drawing Paper,	. .	50 y'd roll $		$
263R.	orange "	20 " "	do.	do.	. . 50 "	"	
264G.	green "	9 " "	do.	do.	. . 50 "	"	
264R.	orange "	9 " "	do.	do.	. . 50 "	"	
265G.	green "	20 " "	mounted on muslin,		20 "	"	
265R.	orange "	20 " "	do.	do.	20 "	"	
267R.	orange "	20 " "	Tracing Paper,	. . .	50 "	"	
267½R.	orange "	9 " "	do.	do.	. . . 50 "	"	
268R.	orange "	20 " "	Tracing Cloth,	. . .	20 "	"	
269G.	green "	20 " "	Columbia Cloth,	. .	20 "	"	
269R.	orange "	20 " "	do.	do.	. . 20 "	"	

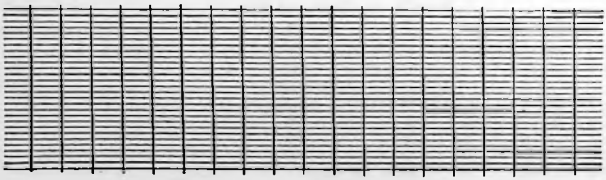


Plate C, 5 × 25 to the inch.

SHEETS ONLY.

270G.	green, engraving	15 × 42 in.,	Drawing Paper,	quire $		sheet $
270R.	orange "	15 × 42 "	do.	do.	"	"

All "Standard" Profile Papers and Cloths bear this trade mark along the margin.

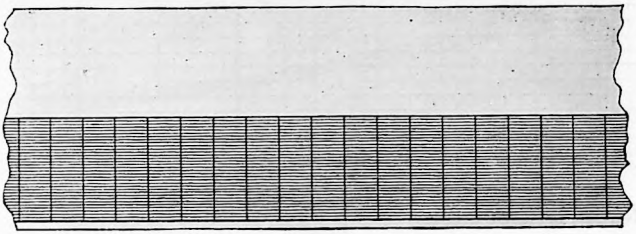
KEUFFEL & ESSER CO. NEW YORK

"STANDARD" PROFILE-PLAN PAPERS AND CLOTHS.

(TRADE MARK)

in continuous rolls.

Width of paper 22 in.



In Profile-Plan Paper, the profile ruling with its margin is only half the width of the paper, the other half being left blank for sketching difficult cuts or fills, embankments or excavations etc. and for explanatory notes. This is a very convenient and accurate method, which saves referring to several maps for the same information. In mapping complicated cuts, fills, embankments, etc., it is indispensable.



Plate A. 4 x 20 to the inch.

	Standard Profile-Plan Papers and Cloths,			yard
253 H.G.	green, engraving	10 in. wide,	Drawing paper, . 50 y'd roll	$ $
253 H.R.	orange, "	10 " "	do. do. . 50 " "	
254 H.R.	orange, "	5 " "	do. do. . 50 " "	
257 H.R.	orange, "	10 " "	Tracing paper, . 50 " "	
257½ H.R.	orange, "	5 " "	do. do. . 50 " "	
258 H.R.	orange, "	10 " "	Tracing cloth, . 20 " "	
258½ H.R.	orange, "	5 " "	do. do. . 20 " "	

251 H.R., 257½ H.R. and 256½ H.R., width of paper 11 in.



Plate B. 4x30 to the inch.

	Standard Profile-Plan Papers and Cloths,			yard
263 H.G.	green, engraving	9 in. wide,	Drawing paper, . 50 y'd roll	$ $
263 H.R.	orange, "	9 " "	do. do. . 50 " "	
267 H.R.	orange, "	9 " "	Tracing paper, . 50 " "	
268 H.R.	orange, "	9 " "	Tracing cloth, . 20 " "	

All "Standard" Profile Papers and Cloths bear this trade mark along the margin.

Samples sent on application, or general sample book for 15c.

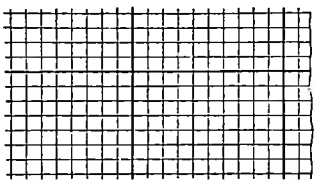
KEUFFEL & ESSER CO. NEW YORK

"STANDARD" CROSS SECTION PAPERS AND CLOTHS.

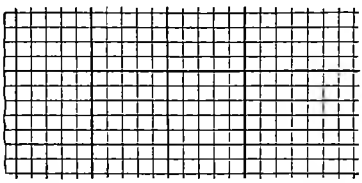
(TRADE MARK)

In sheets and in continuous rolls.

Please order by number.



10 × 10 to the inch,
Nos. 280, 281 and 283 to 289,



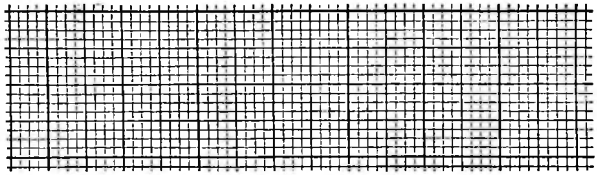
10 × 10 to the inch. 5th line heavy,
Nos. 282 and 282½.

SHEETS.

280 G.	green, engraving	16 × 20 in.,	Drawing Paper,	quire $		sheet $	
280 R.	orange "	16 × 20 "	do. do.	"		"	
280 B.	blue "	16 × 20 "	do. do.	"		"	
281 R.	orange "	16 × 20 "	Tracing Paper,	"		"	

CONTINUOUS.

						yard
282.	green, engraving	24 in. wide,	Drawing Paper,	50 y'd roll $		$
282½.	green "	24 " "	Tracing Paper,	50 " "		
283 G.	green "	20 " "	Drawing Paper,	50 " "		
283 R.	orange "	20 " "	do. do.	50 " "		
285 G.	green "	20 " "	mounted on muslin,	20 " "		
285 R.	orange "	20 " "	do. do.	20 " "		
287 R.	orange "	20 " "	Tracing Paper,	50 " "		
288 R.	orange "	20 " "	Tracing Cloth,	20 " "		
289 G.	green "	20 " "	Columbia Cloth,	20 " "		
289 R.	orange "	20 " "	do. do.	20 " "		



16 × 16 to the inch.

SHEETS.

290 G.	green, engraving	17×22 in.,	Drawing Paper,	quire $		sheet $	
290 R.	orange "	17×22 "	do. do.	"		"	
290 B.	blue "	17×22 "	do. do.	"		"	
291 R.	orange "	17×22 "	Tracing Paper,	"		"	

CONTINUOUS.

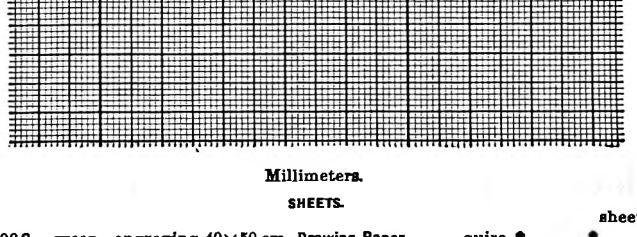
						yard
293 G.	green, engraving	20 in. wide,	Drawing Paper,	50 y'd roll $		$
293 R.	orange "	20 " "	do. do.	50 " "		

All "Standard" Cross Section Papers and Cloths bear this trade mark along the margin.

"STANDARD" CROSS SECTION PAPERS AND CLOTHS.

(TRADE MARK) In sheets and in continuous rolls.

Please order by number.



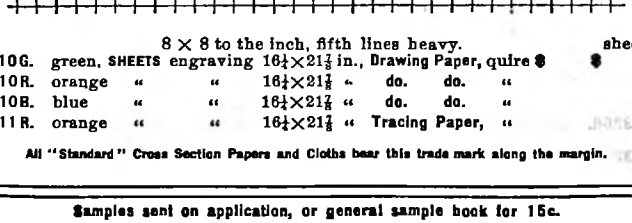
Millimeters.

SHEETS.

						sheet $	$
300 G.	green,	engraving	40×50 cm.	Drawing Paper, . . .	quire		
300 R.	orange	"	40×50 "	do. do. . . .	"		
300 B.	blue	"	40×50 "	do. do. . . .	"		
301 R.	orange	"	40×50 "	Tracing Paper, . . .	"		

CONTINUOUS.

						yard $	$
303 G.	green,	engraving	50 cm.	wide, Drawing Paper,	50 y'd roll		
303 R.	orange	"	50 "	" do. do.	50 " "		
305 G.	green	"	50 "	" mounted on muslin,	20 " "		
305 R.	orange	"	50 "	" do. do.	20 " "		
306 G.	green	"	75 "	" Drawing Paper, .	50 " "		
306 R.	orange	"	75 "	" do. do. .	50 " "		
307 R.	orange	"	50 "	" Tracing Paper, .	50 " "		
307½ R.	orange	"	75 "	" do do. .	50 " "		
308 G.	green	"	75 "	" Drawing Paper, mounted on muslin,	20 " "		
308 R.	orange	"	75 "	" do. do.	20 " "		
308½ R.	orange	"	50 "	" Tracing Cloth, .	20 " "		
309 R.	orange	"	75 "	" Tracing Cloth, .	20 " "		



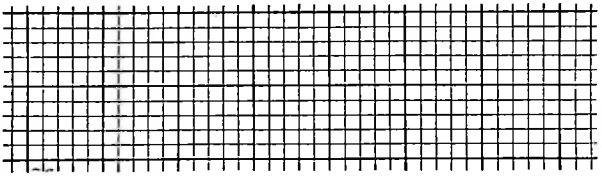
8 × 8 to the inch, fifth lines heavy.

						sheet $	$
310 G.	green,	SHEETS	engraving	16¼×21⅝ in.,	Drawing Paper, quire		
310 R.	orange	"	"	16¼×21⅝ "	do. do. "		
310 B.	blue	"	"	16¼×21⅝ "	do. do. "		
311 R.	orange	"	"	16¼×21⅝ "	Tracing Paper, "		

All "Standard" Cross Section Papers and Cloths bear this trade mark along the margin.

"STANDARD" CROSS SECTION PAPERS IN SHEETS AND ROLLS.

(TRADE MARK) Please order by number.

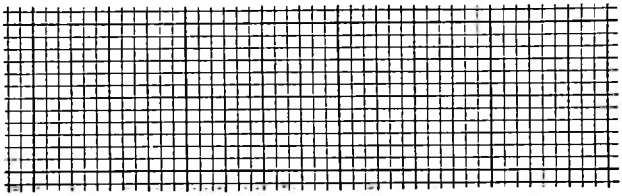


5 × 5 to the half-inch. sheet

320G.	green, SHEETS,	engraving	16×20 in.,	Drawing Paper,	quire	$ $
320R.	orange "	"	16×20 "	do. do.	"	
320B.	blue "	"	16×20 "	do. do.	"	
321R.	orange "	"	16×20 "	Tracing Paper,	"	

10 × 10 to the inch with every second line heavy.

324. green, SHEETS, engraving 16×20 in., Drawing Paper, quire $ $



12 × 12 to the inch. sheet

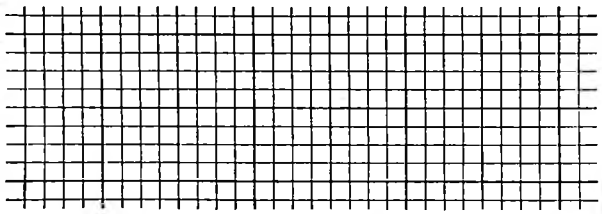
322. green, Sheets, engraving 16 × 20 in., Drawing Paper, quire $ $

All "Standard" Cross Section Papers bear this trade mark along the margin.

SIMPLEX CROSS SECTION PAPER.

In continuous rolls.

Simplex Cross Section Paper is intended for architectural and mechanical full-size detail sketches.

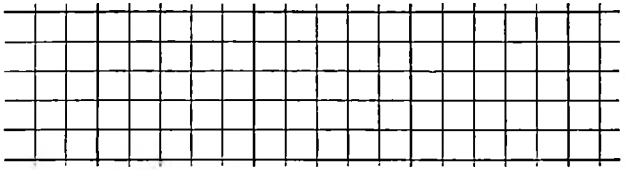


8 × 8 to the inch.

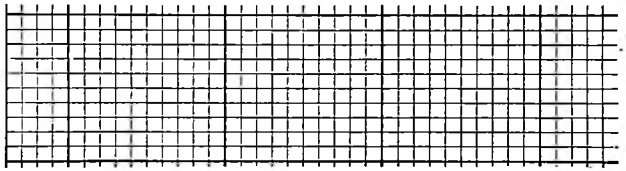
326R.	orange,	CONTINUOUS,	engraving 30 in. wide,	Simplex Detail Paper,	50 y'd. roll, $	yard $
326D.	do.	do.	White Detail Paper,	50 y'd. roll,		"

RULED CROSS SECTION PAPERS

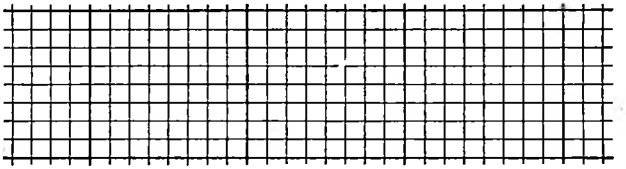
IN SHEETS. DRAWING PAPER.



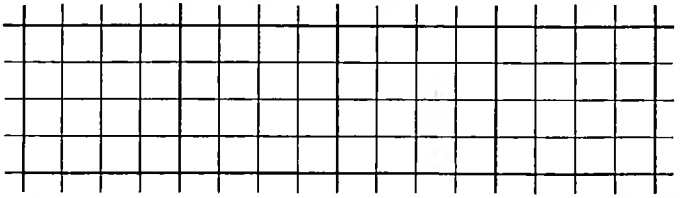
330. Sheets, 16 × 21 in., 5 × 5 to the inch, ruled blue . . . . quire $
ream



331. Sheets, 16 × 21 in., 10 × 10 to the inch, ruled blue . . . quire $
ream

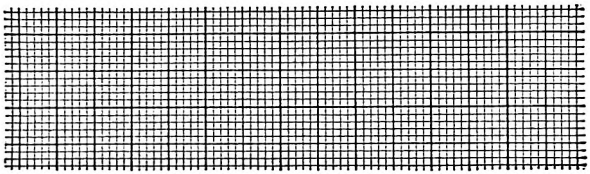


332. Sheets, 16 × 21 in., 8 × 8 to the inch, ruled blue . . . . quire $
ream



333. Topographical Paper, Sheets, 16 × 21 in., 400 feet to the inch,
ruled red and blue . . . . . quire $
ream

CONSTRUCTOR'S SKETCH PAPER.



10 × 10 to the half inch, fifth lines heavy.

334A.	Sheets,	neutral tint,	engraving	5 × 7½ in.,	Tracing Paper .	quire $
334AR.	"	orange	"	5 × 7½ in.,	"	" .	"
334B.	"	neutral tint	"	5 × 7½ in.,	Drawing	" .	"
334C.	"	neutral tint	"	7½ × 10 in.,	Tracing	" .	"
334CR.	"	orange	"	7½ × 10 in.,	"	" .	"
334D.	"	neutral tint	"	7½ × 10 in.,	Drawing	" .	"
334E.	"	neutral tint	"	10 × 15 in.,	Tracing	" .	"
334ER.	"	orange	"	10 × 15 in.,	"	" .	"
334F.	"	neutral tint	"	10 × 15 in.,	Drawing	" .	"

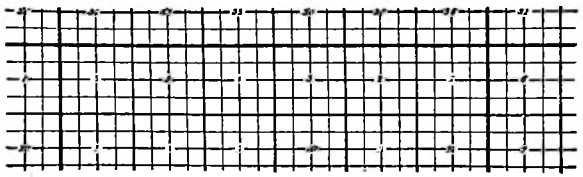
334½. Cross Section Tracing Paper (10×10 to the half inch), fifth line heavy, neutral tint, engraving 20 in. wide, Tracing Paper, per 50 y'd roll . . . . . $ per yard $

Like Contractor's Sketch Paper but continuous.

This paper is printed in a neutral tint and in orange. The lines are indelible, and can be photo-printed. We recommend it for the use of mechanical engineers, students, etc.

CROSS SECTION PAPERS
RULED OR PRINTED, OR OTHER DESIGNS THAN HERE LISTED, MADE TO ORDER IN REASONABLE QUANTITIES.
PRICES QUOTED ON INQUIRY.

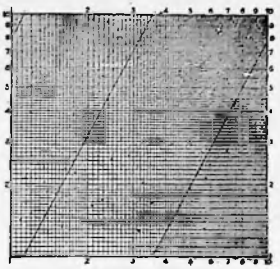
TOWNSHIP PAPER.



335. Sheets, black engraving 15 × 18 in., Drawing Paper, quire . . . . . $ sheet $

LOGARITHMIC CROSS SECTION PAPERS.

DURAND'S LOGARITHMIC PAPER.



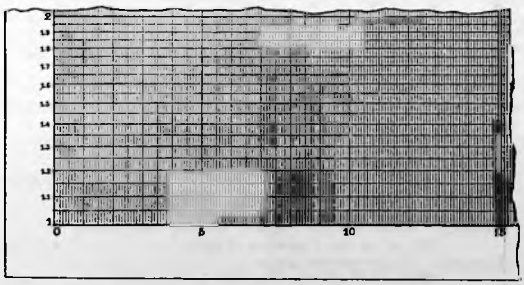
336. Sheets, engraving 10 × 10 in., drawing paper, neutral tint, sheet $ doz.

On this paper the scales in each direction are logarithmic instead of uniform as in other cross section papers. The numbers and divisions marked are placed at such points that their distances from the origin are proportional to the logarithm of such numbers instead of to the numbers themselves. Among the various relationships which may be represented by means of this paper, are: Circumferences and areas of circles in terms of their radii or diameters, or the inverse; moments of inertia and radii of gyration in terms of a linear dimension, or the inverse; length of pendulum and time of oscillation; powers and roots of any and all indices; weights of a series of bodies of the same substance and form but of varying size, or the inverse, in terms of a linear dimension; sizes of shafts, struts, tie bars, etc., in terms of varying load, or the inverse; shearing stress, bending moment or deflection of beams, or the inverse, in terms of load, etc., etc.

JENSEN'S LOGARITHMIC PAPER.

336 J. Sheets, engraving 10 × 10 in., bond paper, printed in orange, sheet $ per doz. $ per hundred

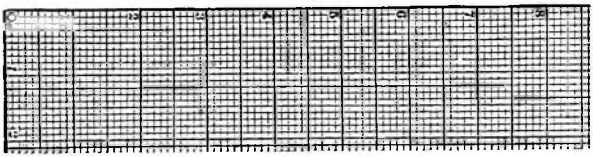
Jensen's Logarithmic Paper is similar to Durand's, but has two logarithmic scales in each direction, instead of one.



336 P Logarithmic Papers . . . . . per sheet $ per dozen $

This is a special logarithmic drawing paper, in sheets 16×21 in., engraving 25×50 cm. The ordinate measures 25 cm. and is divided into logarithmic divisions, the space from 1 to 2, having twenty sub-divisions and from 2 to 3, 3 to 4 etc., up to 10, having ten divisions. The absicissa is divided into equal parts of one millimeter.

WEBB'S CO-ORDINATE PAPER.



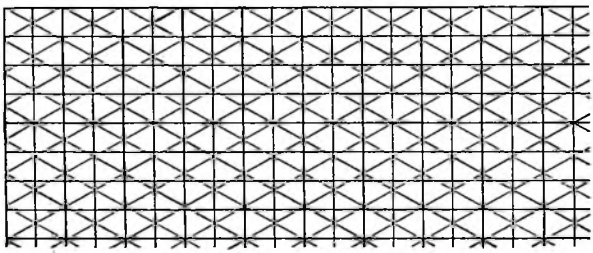
Webb's Co-ordinate paper is a convenient and accurate cross-section paper for drafting rooms, technical schools, laboratories, etc. It is printed from accurate engravings in a neutral olive tint which can be photographed or photo-printed. The scale of the rulings is between the English and French (½ inches and centimeters) subdivided 10 × 10. The lines of Nos. 337 to 337-1L are numbered in two directions for ready reference to any point on the paper and the sheets are punched for portfolio binding. A table of natural tangents is printed on the margin of some of the larger size sheets, for laying off angles.

337.	Best Linen Record Paper,	8¾ × 11⅜ in.,	180 × 220	squares,	sheet	$
337L.	" " " "	11⅜ × 17¾ "	240 × 350	"	"	
337-1.	Best thin Bond Paper,	8¾ × 11⅜ "	180 × 220	"	"	
337-1L.	" " " "	11⅜ × 17¾ "	240 × 350	"	"	
337-2.	" " " "	8 × 10½ "	160 × 220	"	"	
337-2L.	" " " "	10½ × 16 "	220 × 330	"	"	
337-3.	Smooth Drawing Paper,	8 × 10½ "	160 × 220	"	per block of 50 sheets	

For Nos. 338 A-H and 339, see page 40.

For Nos. 340, 341 and 341½, see pages 41 and 42.

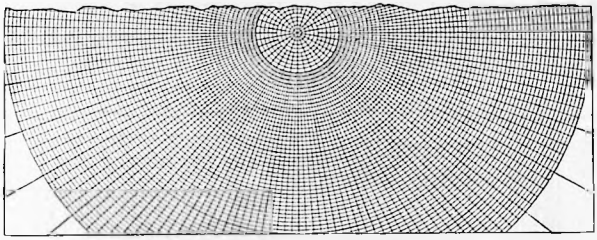
ISOMETRIC CROSS-SECTION PAPER.



No. 842. **Printed in neutral tint.**

342A.	Isometric Cross-section paper, sheets, engraving 6 × 9 in., Drawing Paper	per quire	$
342B.	Isometric Cross-section paper, sheets, engraving 9 × 12 in., Drawing Paper	"	"
342C.	Isometric Cross-section paper, sheets, engraving 12 × 18 in., Drawing Paper	"	"
342AP.	Isometric Cross-section paper, Pad of 40 sheets, No. 342 A, 6 × 9 in. . .	each	
342BP.	Isometric Cross-section paper, Pad of 40 sheets, No. 342 B, 9 × 12 in. . .	"	
342CP.	Isometric Cross-section paper, Pad of 40 sheets, No. 342 C, 12 × 18 in. . .	"	

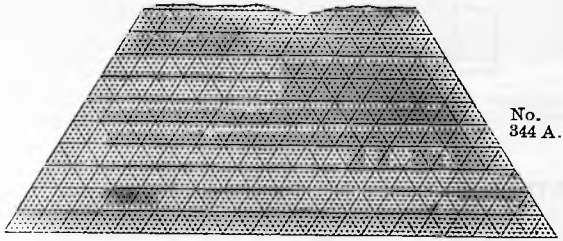
POLAR CO-ORDINATE PAPER.



No. 343 A. **Printed in neutral tint.**

343A. Polar Co-ordinate Paper, sheets, engraving 7 × 10 in., Drawing Paper . . . . . per quire $

343B Polar Co-ordinate Paper, like No. 343A., but Tracing Paper . . . . . " "

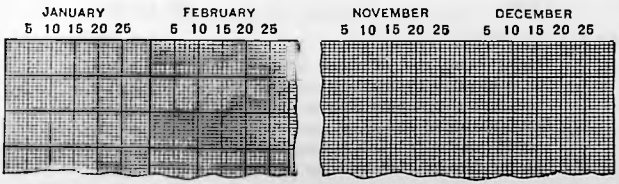


No. 344 A.

344 A. Triangular Co-ordinate Paper . . . . . per quire $

For the graphical expression of three variables composing a constant sum. The engraving is an equilateral triangle, each side 200 mm. long, divided into 100 equal parts. These divisions are connected by rulings parallel to the sides, every fifth line heavy; printed on tracing paper; sheets 8½×12¼ in.

For No. 345, A-D, see page 40.



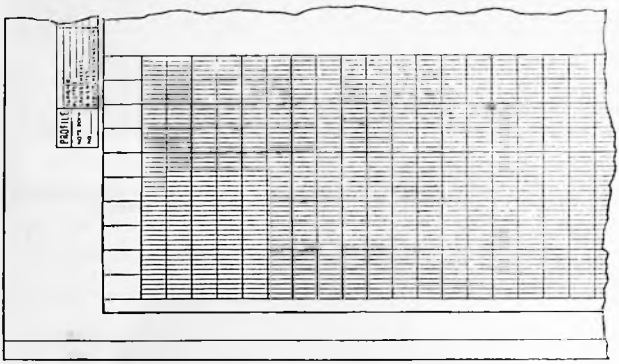
348. "Progress" Cross Section Paper (for statistical work). . . . . per quire $

The engraving is 7×12 in., including border lines, on tracing paper 8½×14 in. The base line is divided into 366 equal parts, corresponding to the number of days per year (365 or 366). Heavy lines separate the twelve months, the names being printed at the head of each column. Of the 200 horizontal lines, every tenth line is heavy to facilitate reading.

KEUFFEL & ESSER CO. NEW YORK

FEDERAL AID SHEETS.

as recommended by the U. S. Department of Agriculture, Office of Public Roads and Rural Engineering.



No. 346-2P

346-1P. Plan Profile Sheet, orange, Tracing Paper, size of sheet 23×36 in., size of border line 22×33½ in., size of profile 10×33½ in. Profile lengthwise ruled to the half inch, in height to one-tenth of an inch. Two titles for profile and plan on left-hand side of sheet, outside of border line . . . . . per hundred $

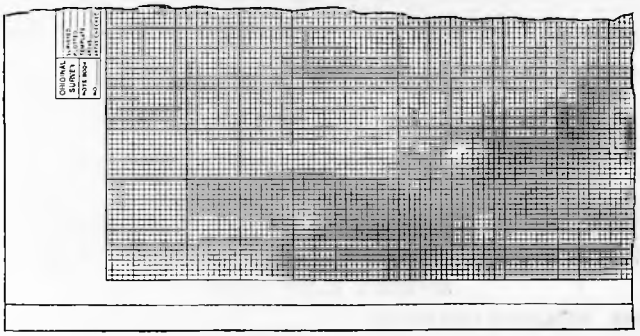
346-1C. Plan Profile Sheet, like No. 346-1P. but Imperial Tracing Cloth . . . . . per hundred $

346-2P. Double Plan Profile Sheet, for flat profiles, orange, Tracing Paper, size of sheet, border line and titles like No. 346-1P. Profile beginning at the bottom of the sheet has the same ruling as sheet No. 346-1P. on the first quarter of the sheet; size of profile 5×32 in.; the second quarter is blank, the third quarter bears a profile like the first quarter, and the fourth quarter is blank. . . . . per hundred $

346-2C. Double Plan Profile Sheet like No. 346-2P. but Imperial Tracing Cloth . . . . . per hundred $

FEDERAL AID SHEETS

as recommended by the U. S. Department of Agriculture, Office of Public Roads and Rural Engineering.



No. 346-3 P.

346-3 P. Cross Section Sheet, orange, **Tracing Paper**, size of sheet 23×36 in., size of border line 22×33½ in., size of profile 21×33½ in. Profile 10×10 to the inch, every tenth line heavy. Two titles for Original Survey and Final Survey on left-hand side of sheet, outside of border line . . . . . per hundred $

346-3C. Cross Section Sheet like No. 346-3P, but Imperial Tracing Cloth . . . . . per hundred $

346-4 P. Plan Cross Section Sheet, orange, **Tracing Paper**, size of sheet, border line and titles like No. 346-3 P. Cross section ruling beginning at the bottom of the sheet is the same as on 346-3 P. It fills half of the sheet, size of profile 10×33½ in.; the second half being blank . . per hundred $

346-4C. Plan Cross Section Sheet, like No. 346-4 P. but Imperial Tracing Cloth . . . . . per hundred $

KEUFFEL & ESSER CO. NEW YORK

"STANDARD"

BLANKS FOR THE BUILDING TRADES.

BLANK FORM SPECIFICATIONS AND REMINDER.

For Frame and Brick Buildings, costing from $500 to $15,000.

The attention of Architects and the Building Trades is called to these IMPROVED FORMS of SPECIFICATIONS, CONTRACTS, etc. We call special attention to the fact that this revision of the form of Contract, including Bond and Contractor's Statements, etc., is based upon the revised Lien Laws. Appreciation of the previous editions has induced us to spare no expense for legal and architectural talent to bring the new edition up to date. The fly-leaf "Reminder" is highly appreciated by the profession in general.

338A. STANDARD SPECIFICATIONS.

Single sets . . . . . $

Dozen sets . . . . . .

100 sets . . . . . .

The "Standard" Blank Form Specifications consist of fourteen sheets in strong manilla cover, containing the following blank forms:

Preamble.	Galvanized Iron.	Agreement between Owner and Contractor (with Bond
Masons, Cut Stone	Iron, (Structural)	Contractor's Statement
Plasterers.	Heating, Steam or Hot Water	Architect's Reminder (on inside of cover)
Carpenters.	Heating, Furnace.	
Painters, Glaziers	Electric Wiring	
Plumbers, Gas Fitters, Sewers		

SEPARATE BLANK FORMS.

338C. BUILDING CONTRACT,
Per 100 $ per quire $

338D. BUILDING CONTRACT—WITH BOND,
Per 100 $ per quire $

338F. CONTRACTOR'S STATEMENT,
Per 100 $ per quire $

338G. MECHANIC'S LIEN NOTICE,
Per 100 $ per quire $

338H. WAIVER OF LIEN,
Per 100 $ per quire $

339. ARCHITECT'S CERTIFICATE BOOK,
Per book (100 blanks with stubs) $

STANDARD DOCUMENTS

OF THE AMERICAN INSTITUTE OF ARCHITECTS.

349A. Agreement and General Conditions, in cover, ... each

349B. Bond of Suretyship . . . . . "

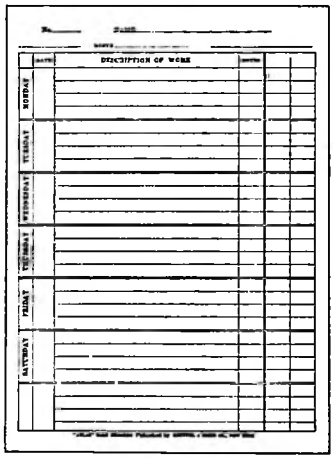
349C. Form of Sub-contract . . . . . "

349D. Letter of Acceptance of Sub-contractor's Proposal . . "

349E. Standard form of Agreement between Owner and Architect on the percentage Basis . . . . "

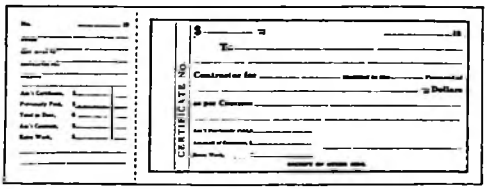
349S. Complete Set . . . . . "

ATLAS TIME RECORD AND EXPENSE SHEET.



340. Atlas Time Record and Expense Sheet, size of sheet 5¾×9 in. for keeping a correct, simple and rapid record of the time spent on any work. 82 sheets with paper cover . . . . . each $

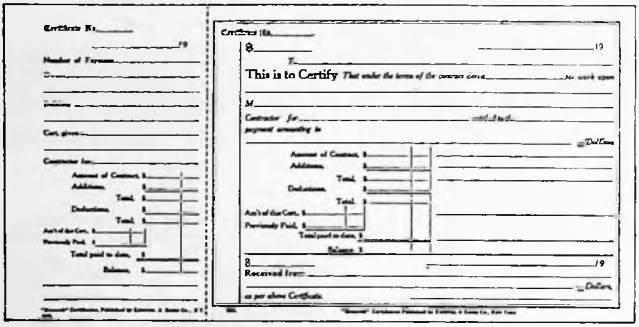
CRESCENT CERTIFICATE BOOK.



341½-I. Crescent Certificate Book, size of sheet 3½×9 in., 100 sheets in linen cover, with imprint of customer's name . each $

341½. do. without imprint . . . . . "

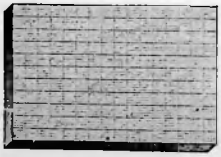
MONARCH CERTIFICATE BOOK.



341-I. Monarch Certificate Book, size of sheet $6\frac{5}{16} \times 12$ in., sheets in linen cover, with imprint of customer's name, . each $

341. without imprint . . . . . "

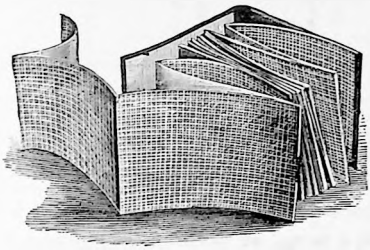
CROSS SECTION BLOCKS.



357A.	size of sheet	5 × 7	in.,	10 × 10 to the inch,	24	sheets, . . .	each $
357B.	do.	5 × 7	"	8 × 8 " " "	24	" . . .	"
357C.	do.	$12\frac{1}{2} \times 20$	cm.,	metric,	24	" . . .	"
358A.	do.	7 × 10	in.,	10 × 10 " " "	24	" . . .	"
358B.	do.	7 × 10	"	8 × 8 " " "	24	" . . .	"
358C.	do.	20 × 25	cm.,	metric,	24	" . . .	"

PROFILE AND CROSS SECTION BOOKS AND BLOCKS.

PRINTED IN GREEN.



No. 350.



350 closed.

PROFILE BOOKS, CONTINUOUS.

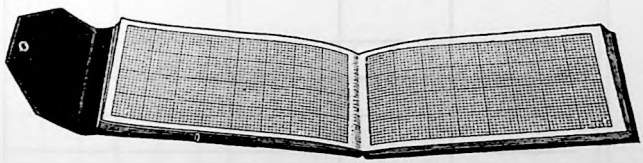
Flexible morocco Covers with Flap and Clasp.

Thin, tough paper mounted on muslin and folded like a map, so that these books take the place of the continuous (roll) profile paper.

Each double page contains six thousand feet—a "Section," as generally laid out for the construction of a road.

350- 12.	Plate A.	4 × 20	to the inch,	engraving	5 × 7½	in.,	12	miles, each $
350- 25.	"	"	"	"	"		25	" "
350- 50.	"	"	"	"	"		50	" "
350-100.	"	"	"	"	"		100	" "
351- 12.	Plate B.	4 × 30	to the inch,	engraving	4⅛ × 7½	in.,	12	miles, each $
351- 25.	"	"	"	"	"		25	" "
351- 50.	"	"	"	"	"		50	" "
351-100.	"	"	"	"	"		100	" "

351M- 25.	Metric, green,	engraving	10 × 20	cm.,	25	pages, ...	each $
351M- 50.	"	"	"	"	50	"	"
351M-100	"	"	"	"	100	"	"
351M-200.	"	"	"	"	200	"	"



Cross Section Books.

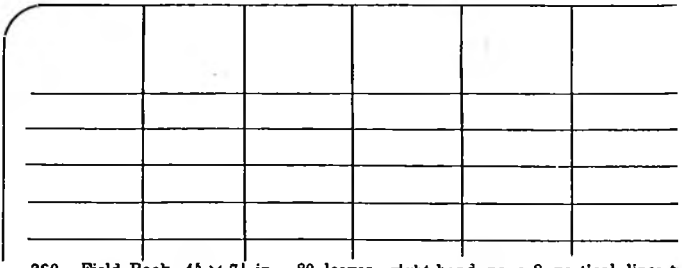
FLEXIBLE COVERS, WITH FLAP AND PENCIL LOOP, 60 LEAVES.

359A.	10 × 10	to the inch,	engraving,	4 × 8	in.,	both sides . . .	each $
359B.	8 × 8	every 8th line heavy,	4 × 8	"	"	" . . .	"

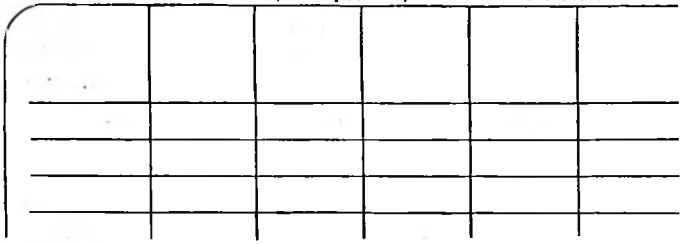
For Cross Section Books with board covers, see pages 48, 49.

ENGINEER'

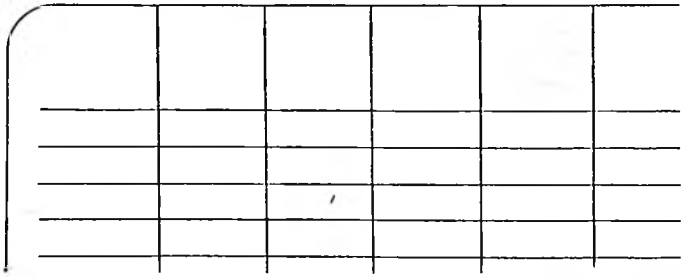
Our Field and Cross-section Books are superior to all others. The paper is of excellent qua
These books are bound in sheepskin in the best and most substantial man
OTHER PATTERNS OF FIELD, CROSS-SECTION AND RECORD BOO



360. Field Book, $4\frac{5}{8} \times 7\frac{1}{4}$ in., 80 leaves, right-hand page 8 vertical lines t
361. Field Book, like No. 360, but 60 leaves, with Keith's and Hall's Tables . . .
361 ½. " " " No. 361, but $4\frac{1}{4} \times 7$ in., ...



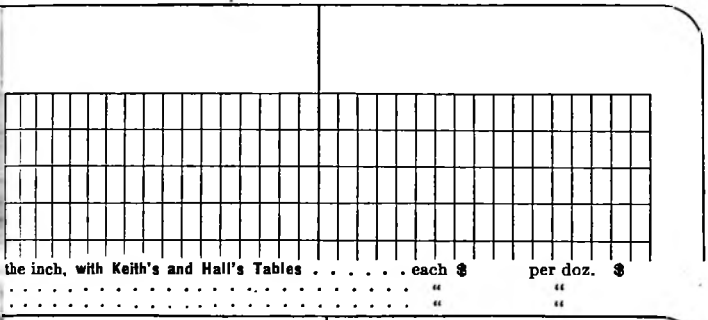
363. Mining Transit Book, $4\frac{5}{8} \times 7\frac{1}{4}$ in., 80 leaves, right-hand page 8 × 8 to t
for each 10 minutes of arc, and Hall's Tables . . . . . .



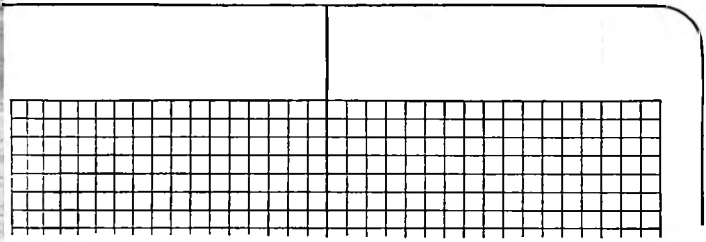
364. Field Book, $4\frac{5}{8} \times 7\frac{1}{4}$ in., 80 leaves, right-hand page 4 × 4 to the inch, wi
Keith's Tables (for R. R. Engineers) consist of: Minutes in decimals of a degree, Inches in decimals
and Externals to a 1° curve, Table of Deflections for Sub-chords, General Curve Formula, Table of Natural Sin

FIELD BOOKS.

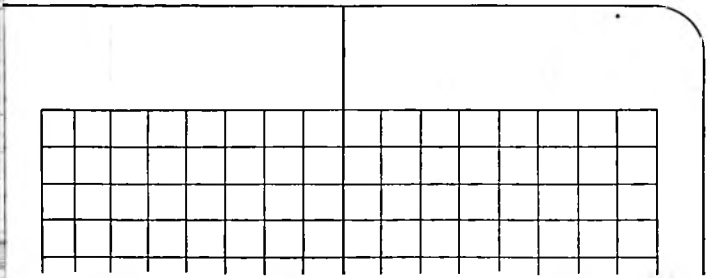
and good weight, taking pencil or ink, and the rulings are correctly spaced and weather proof. and have round corners, board covers and round back, so as to open flat.
MADE TO ORDER.



the inch, with Keith's and Hall's Tables . . . . . each $ per doz. $
. . . . . " "
. . . . . " "

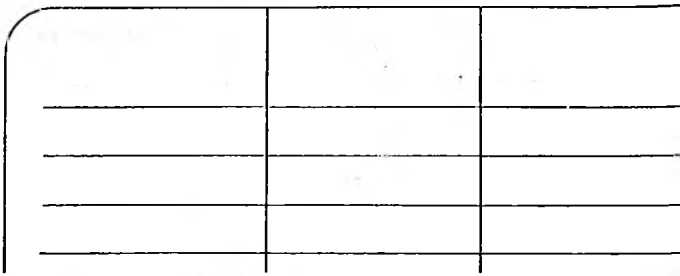


inch, with Tables of Natural Trigonometrical Ratios
. . . . . each $ per doz. $

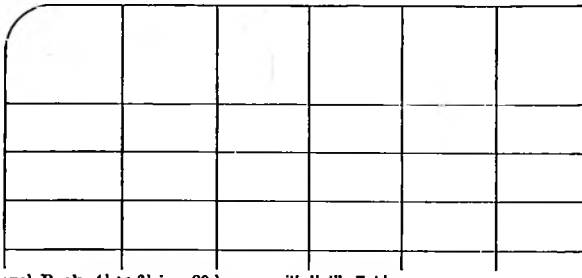


Keith's and Hall's Tables . . . . . each $ per doz. $
a foot, Radii, Ordinates and Deflect' ns, Tangents and Externals to a 1° curve, Corrections for table of Tangents to every 10 minutes of arc, Table ... tural Tangents to every 10 minutes of arc.

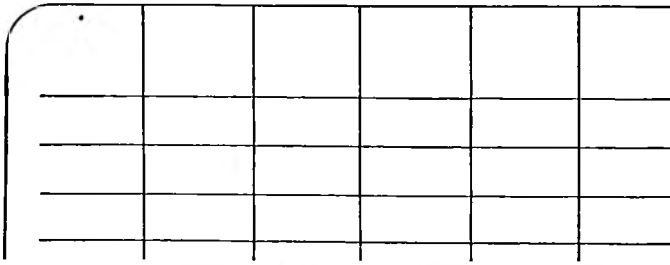
Roadway 18 feet, Slope 1 : 1, and Roadway 14 feet, slope 1½ to 1.



365. Transit Book, $4\frac{5}{8} \times 7\frac{1}{4}$ in., 80 leaves, with Keith's and Hall's Tables . . . .
366. Transit Book, like No. 365, but 60 leaves, do. do. do. . . . .



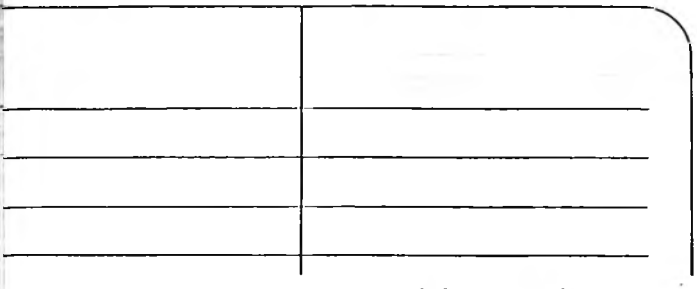
370. Level Book, $4\frac{1}{2} \times 6\frac{1}{2}$ in., 80 leaves, with Hall's Tables . . . . . .
371. Level Book, like No. 370, but 60 leaves, with Hall's Tables . . . . . .



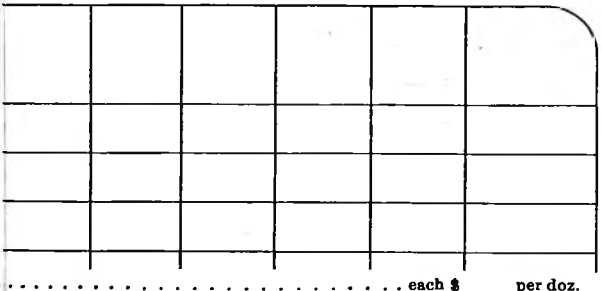
373. Level book, $4\frac{5}{8} \times 7\frac{1}{4}$ in., 80 leaves, with Hall's Tables . . . . . .
374. Level book, like No. 373, but 60 leaves, with Hall's Tables . . . . . .

Hall's Tables for Excavations and Embankments compris

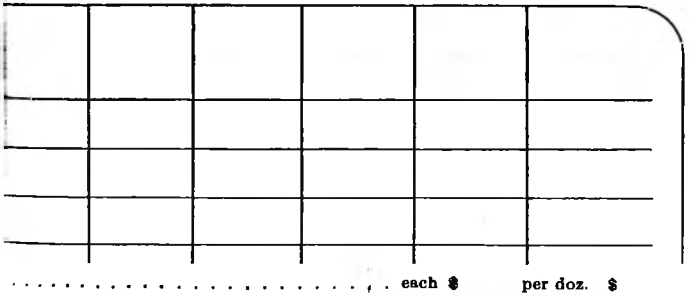
For Cross Section Books wi



. . . . . each $ per doz. $
. . . . . " "



. . . . . each $ per doz. $
. . . . . " "

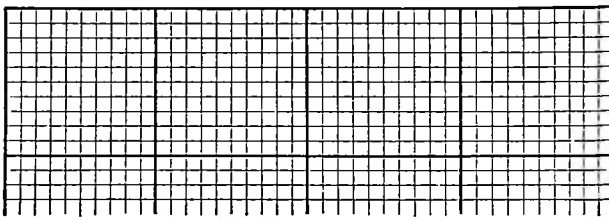


. . . . . each $ per doz. $
. . . . . " "

Roadway 18 feet, Slope 1:1, and Roadway 14 feet, Slope 1½ to 1.

flexible covers, see page 43.

CROSS SEC



375 S. Cross-section Book, $4\frac{1}{2} \times 7\frac{1}{2}$ in., 10 × 10 to the inch, 80 leaves, with Hal
375. Cross-section Book, $5\frac{1}{2} \times 7\frac{1}{2}$ in., 10 × 10 to the inch, 80 leaves, with Hal
376. Cross-section Book, $6\frac{1}{2} \times 8\frac{1}{2}$ in., 10 × 10 to the inch, 80 leaves, with Hal

SECTION.

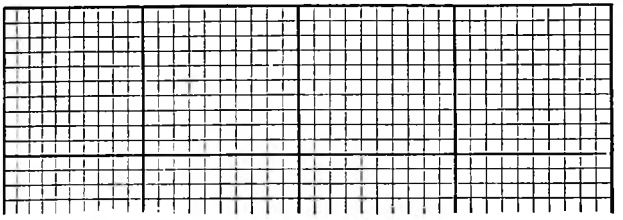
Sta.	Elev.	Grade	Cut or Fill.		
			Left	C.	Right

380. Earthworks Book, 5 × $7\frac{3}{4}$ in., 80 leaves, with Keith's and Hall's Tabl

385. Topographical Book, $5\frac{1}{2}$ × $8\frac{1}{8}$ in., right-hand page 4 × 4 to the inch,

KEUFFEL & ESSER CO. NEW YORK

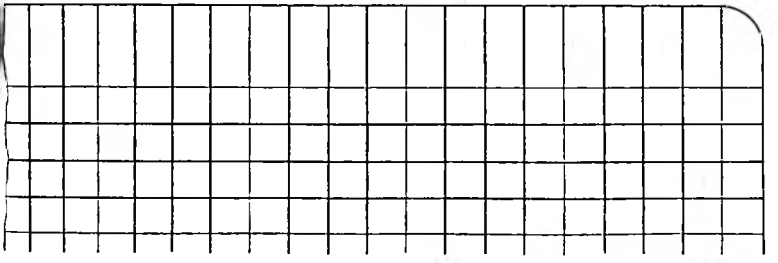
ION BOOKS.



Tables, printed in blue . . . . . each $ per dozen $
Tables, " " " . . . . . " " "
Tables, " " " . . . . . " " "

AREA'S		Cubic Yds.		Remarks
EXCAVATION	Embankment	Excav.	Embank.	

(see page 44) . . . . . each $ per dozen $



leaves. . . . . each $ per dozen $

ENGINEER'S FIELD BOOKS.

AS DESCRIBED ON PAGES 44 TO 49 BUT WITH IMITATION LEATHER COVERS.

360 A.	Field	Book,	like	No. 360	but with Imitation Leather Cover, ...	each $	per doz. $
361 S. A.	do.	do.	like	No. 361 S.	do.	"	"
361 A.	do.	do.	like	No. 361	do.	"	"
363 A.	do.	do.	like	No. 363	do.	"	"
364 A.	do.	do.	like	No. 364	do.	"	"
365 A.	do.	do.	like	No. 365	do.	"	"
366 A.	do.	do.	like	No. 366	do.	"	"
370 A.	do.	do.	like	No. 370	do.	"	"
371 A.	do.	do.	like	No. 371	do.	"	"
373 A.	do.	do.	like	No. 373	do.	"	"
374 A.	do.	do.	like	No. 374	do.	"	"
375 S. A.	do.	do.	like	No. 375 S.	do.	"	"
375 A.	do.	do.	like	No. 375	do.	"	"
376 A.	do.	do.	like	No. 376	do.	"	"
380 A.	do.	do.	like	No. 380	do.	"	"
385 A.	do.	do.	like	No. 385	do.	"	"

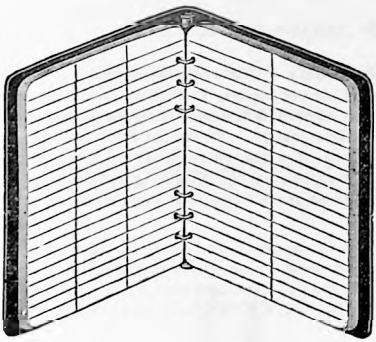
ENGINEER'S DUPLICATING FIELD BOOKS.

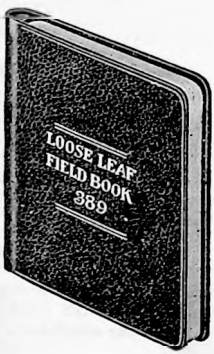
GENUINE LEATHER COVERS.

Original, as well as duplicate pages, are numbered. Original sheets are perforated, and may be placed in loose leaf folders if desired. On the inside of the back cover is a container holding six carbon papers in oil paper sheath. With Keith's and Hall's Tables.

361 D.	Field	Book,	ruling	like No. 361	but with carbon paper and duplicate sheet, ...	each $	per doz. $
363 D.	do.	do.	like	No. 363	do.	"	"
366 D.	do.	do.	like	No. 366	do.	"	"
371 D.	do.	do.	like	No. 371	do.	"	"
374 D.	do.	do.	like	No. 374	do.	"	"

LOOSE LEAF FIELD BOOKS.





The binders have stiff covers of Black Imitation Leather, are extremely strong and durable and most suitable for rough field use. The mechanism is durable, works easily and its six rings guard against tearing of the sheets. Hall's Tables, printed on a heavy xylonite fly leaf, are included with the binders.

389. Binder only for Loose Leaf Field Books, 7½×4½ in. . . . . each $

390. " " " " " " " 6½×4 " . . . . . "

We furnish loose leaves in sets of 50 leaves, which is about the carrying capacity of the binder. These leaves are not machine ruled but printed from an engraving like our Field Books and the ink is waterproof.

The following Loose Leaves fit Binder No. 389:

N 361 L, Field Book rulings like No. 361

N 363 L, Mining Transit Book rulings like No. 363

N 366 L, Transit Book rulings " " 366

N 374 L, Level Book rulings " " 374

The following Loose Leaves fit Binder No. 390:

N 371 L, (Level Book rulings like No. 371)

N 361L, N 363L, N 366L, N 371L, N 374L, Leaves for Loose Leaf Field Books, ... per set of 50 leaves $

N 361L is old No. 361½L, etc.

SURVEYOR'S CONVERSION TABLES.

395. Surveyor's Conversion Tables, rods to feet, chains to feet and vice versa; printed on tough paper in pamphlet form, with extra wide blank margin so that they can be trimmed to fit the field book into which they are inserted. . . . . each $ post-paid $

DRAWING INSTRUMENTS.

Before the war very few drawing instruments had been made in the United States; they were imported almost entirely from Europe. Among the imported drawing instruments our PARAGON brand occupied a unique position by reason of their extremely high quality. These instruments are specimens of the craftsman's art at its best; they cannot be produced by machinery. The artisans creating PARAGON instruments served a long period of apprenticeship, and their degree of technical proficiency can be attained only after years of training.

For those, who, in addition to accuracy and quality of workmanship, demand that beauty of finish and artistic touch which is characteristic of the work of the true craftsman, we are glad to announce that we are again able to furnish PARAGON DRAWING INSTRUMENTS fully up to the high standard of pre-war excellence.

DRAWING INSTRUMENTS NOW MADE IN THE UNITED STATES.

When in the course of the war we decided to take up the manufacture of drawing instruments in the United States, we were under the necessity of selecting designs adapted to regular manufacturing methods. This led to the production of our ANCHOR and PILOT DRAWING INSTRUMENTS, now recognized as preeminently the foremost American-made instruments. (see pages 86 to 98).

We are proud of the success attained in transplanting this industry into the United States; this involved such great effort and expense, however that we should be very loath to discontinue the manufacture of these instruments even when Europe is again able to supply drawing instruments in sufficient quantities. We trust, therefore, that we may count upon the loyal support of our patrons in the matter of keeping alive this new American industry.

ANCHOR DRAWING INSTRUMENTS represent the successful result of our efforts to produce a high-grade instrument of simplified construction, salable at a reasonable price. The symmetry of form and proper balance which we consider indispensable in any high-grade drawing instrument, have been maintained. The materials used, nickel-silver and fine tool steel, are the best obtainable. In the production of these instruments it has been our endeavor to uphold the high standard of perfection for which **K & E** products are well known.

PILOT DRAWING INSTRUMENTS are similar to our high-grade ANCHOR DRAWING INSTRUMENTS but are of simpler construction, intended to meet the demand for serviceable and durable instruments at a moderate price.

PARAGON INSTRUMENTS

WITH ESSER'S PATENT PIVOT JOINT.

THE VERY BEST INSTRUMENTS MADE.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.

We list the Paragon Compasses with Esser's Patent Pivot joint; also with the insertion pieces with round shank aligned by a steel feather and held in a spring socket. This construction dispenses with the thumbscrew. (See cuts 608, 610 R &c.)



No. 601.



603 H.



604 H.



605 H.

601. Hairspring Divider, 4 in. . . . . each $

603 H. Compasses, 4¼ in., with fixed Needle Point, Pen and Pencil Point, and with Hairspring . . . "

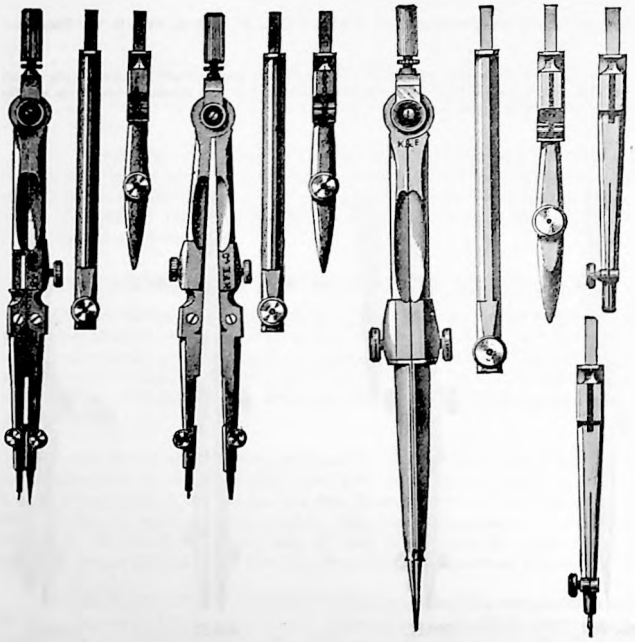
604 H. Compasses, 4¼ in., with fixed Needle and Pen Point, and with Hairspring . . . . . "

605 H. Compasses, 4¼ in., with fixed Needle and Pencil Point, and with Hairspring . . . . . "

For empty cases for instruments, see page 99.

PARAGON INSTRUMENTS.

Each Instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 611. 611 H. 612.

611. Compasses, 5 in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar . . . each $

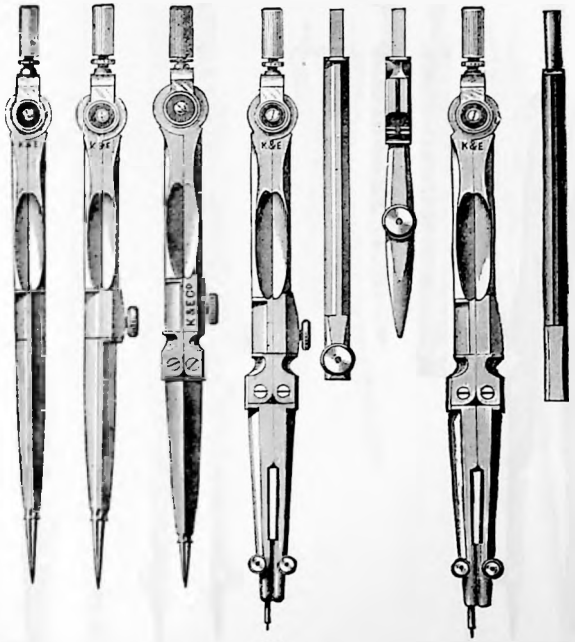
611 H. do. 5 " like No. 611, but with Hairspring . . "

612. do. 6¼ " with 2 Steel Points, Pen, Pencil, Needle Point and Lengthening Bar . . "

For empty cases for Instruments, see page 99.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 606. 608. 608½. 610. 610 R.

606. Plain Divider, 5¾ in. . . . . each $

607. do. 6¾ " . . . . . "

608. Hairspring Divider, 5¾ in. . . . . "

608½. do. do. 5¾ " with Joint in each leg . . . . "

609. do. do. 6¾ " . . . . . "

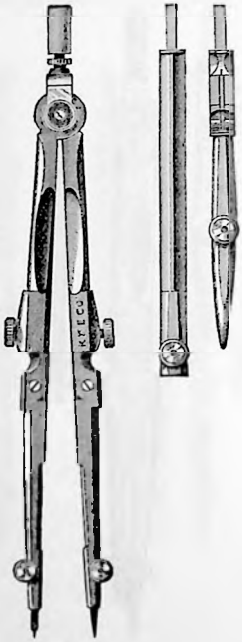
610. Compasses, 6¼ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar . . . . "

610 R. do. 6¼ in., like No. 610, but the insertion pieces with round shank (no thumbscrew) . "

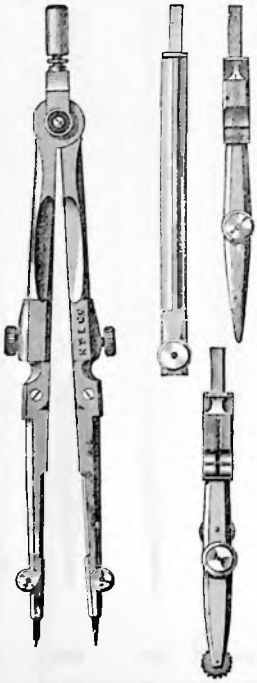
For empty cases for instruments, see page 99.

PARAGON INSTRUMENTS.

Each Instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y Paragon.



No. 610 H.



610 HD.

610 H. Compasses, 6¼ in. like No. 610, but with Hairspring . . each $

610 HD. do. 6¼ " like No. 610H, but with improved Dotting Pen with 6 wheels . . . . . "

610 K. Compasses, 6¼ in., with fixed Needle point, Knife Spring Pen Point, Pencil Point and Lengthening Bar "

The Knife Spring Paragon Bow Pens have a hinged upper blade actuated by a spring similar to a pocket knife, which either holds the pen open at 90 degrees or presses it firmly against the fixed blade.

Opening the pen for cleaning does not change the adjustment for width of line.

For illustration of Knife Spring Pen, see page 68.

For empty cases for instruments, see page 99.

PARAGON INSTRUMENTS.

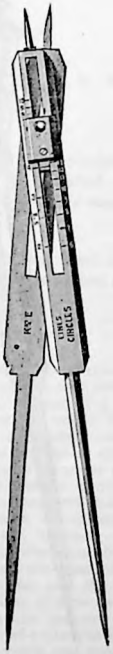
Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 431.



433.



435.

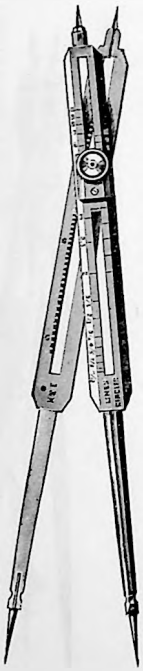
431. Three-legged Dividers, one leg adjustable for length, 6 in.
Morocco Case, silk velvet lined . . . . . each $

433. Proportional Dividers, 6½ in., for lines . . . . . "

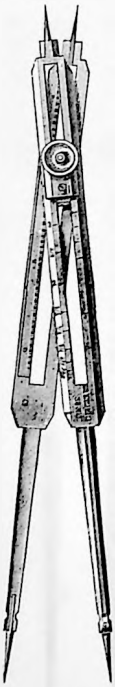
435. Proportional Dividers, finely divided for lines and circles, 7¾ in., ... "
Morocco Case, silk velvet lined . . . . . "

PARAGON INSTRUMENTS.

Each Instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 437.



439.

437. Proportional Dividers, finely divided for lines and circles, $9\frac{1}{4}$ in., with Rack-Movement . . . . . "
Morocco Case, silk velvet lined . . . . . "

439. Proportional Dividers, finely divided for lines and circles, $9\frac{1}{4}$ in., with Rack-Movement . . . . . "
Morocco Case, silk velvet lined . . . . . "

Paragon Proportional Dividers have Steel Legs with Adjustable Steel Points.

PARAGON INSTRUMENTS.

UNIVERSAL

PROPORTIONAL DIVIDERS.

Each Instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 440.

440. Universal Proportional Dividers (Registered) 10 in., with Rack Movement, in polished Mahogany Case, with Table of Settings each $8

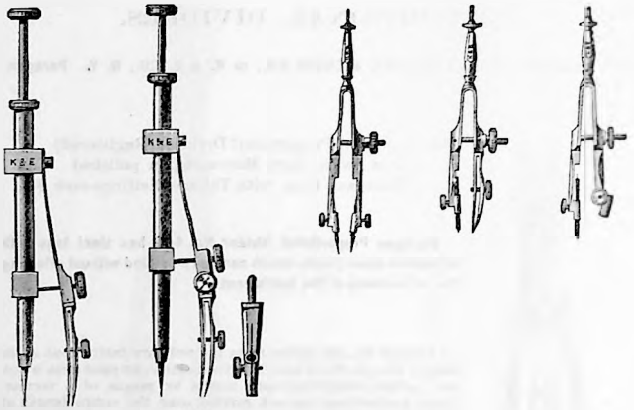
Paragon Proportional Divider No. 440 has steel legs with adjustable steel points which can be re-pointed without affecting the correctness of the instrument.

Divider No. 440 differs from the ordinary instrument of its kind in that its whole length is divided into 200 equal parts, which are further subdivided into tenths by means of a vernier. These graduations are not carried over the entire length of the instrument, because those seen in the figure from 10 to 110 reading with the vernier to 2000ths, are practically all that are necessary for the almost endless variety of purposes to which these Dividers may be applied. By this method of graduation any desired ratio may be set off. Thus, setting 483 (taken from many others in a table of settings which accompanies each instrument) gives the ratio between the diameter and the circumference of a circle; in other words, when the slide is set to this number by means of the vernier, the opening at one end will take in the diameter of a circle, and the opening between the points of the other end gives at once its circumference reduced to lineal measure. In like manner we have settings for such ratios as the diameter of a circle and the side of an equal square, feet and metres, yards and metres, etc. The list of settings for Lines, Planes and Solids, inclosed with each instrument, is much more complete than the series of fixed graduations on the best Dividers of the old style. The setting of the slide from such a table is effected more easily and more accurately than can be done by the ordinary method. By means of the fully graduated scale very small departures from a given ratio can be detected at once.

Any other desired setting not found in the list, may be obtained by means of a very simple formula given with the table of settings.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 453. 454. 460½. 461½. 462½.

453. Drop Spring Bow Pen, 4 in., spring blade, for very small circles, each $
Morocco Case, silk velvet lined . . . . . "

454. Drop Spring Bow Pen, spring blade, and Pencil, 4 in., for very small circles . . . . . "
Morocco Case, silk velvet lined . . . . . "

460½. Minute Steelspring Bow Dividers, with 2 Needle Points, Metal Handle, 2¼ in. . . . . "

461½. " " " Pen, spring blade, with Needle Point, Metal Handle, 2¼ in. . . . . "

462½. " " " Pencil, with Needle Point, Metal Handle, 2¼ in. . . . . "

Nos. 453 and 454 are the most suitable instruments for drawing small circles. In these types the center rod remains stationary while the instrument is turned and pen or pencil draw by their own weight; this obviates slipping of the needle and scratching of the pen.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 476.



477.



478.

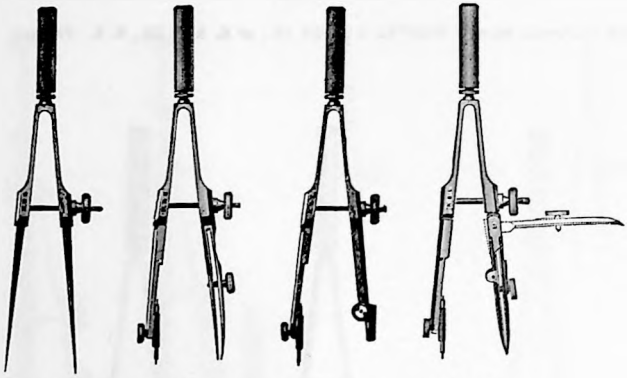
476. Steelspring Bow Dividers, with nickel silver Handle, ... 5 in., each $

477. " " Pen, spring blade, with Needle Point, nickel silver Handle, 5 " "

478. " " Pencil, with Needle Point, nickel silver Handle . . . 5 " "

PARAGON INSTRUMENTS.

Each Instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 480. 481. 482. 481 K.

480. Steelspring Bow Dividers, nickel silver Handle, 3¾ in., each $

481. " " Pen, spring blade, Needle Point, nickel silver Handle . . . . . 3¾ " "

482. " " Pencil, Needle Point, nickel silver Handle . . . . . 3¾ " each $

481 K. Steelspring Bow Pen, Knife Spring Pen, Needle Point, nickel silver Handle . . . . . 3¾ " "

The Knife Spring Paragon Bow Pens have a hinged upper blade actuated by a spring as in a pocket knife, which either holds the pen open at 90 degrees or presses it firmly against the fixed blade.

Opening the pen for cleaning does not change the adjustment for width of line.

For illustration of Knife Spring Pen, see page 68.

480½. Steelspring Bow Dividers, nickel silver Handle, 3½ " "

481½. " " Pen, spring blade, Needle Point, nickel silver Handle . . . . . 3½ " "

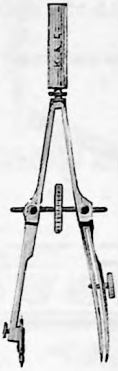
482½. " " Pencil, Needle Point, nickel silver Handle . . . . . 3½ " "

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 485.



486.



487.

485. Steelspring Bow Dividers, with central thumbnut, nickel silver Handle, $3\frac{3}{4}$ in. . . . . each $

486. Steelspring Bow Pen, spring blade, central thumbnut, with Needle Point, nickel silver Handle, $3\frac{3}{4}$ in., ... "

487. Steelspring Bow Pencil, central thumbnut, with Needle Point, nickel silver Handle. $3\frac{3}{4}$ in., ... "

Steelspring Bows Nos. 485, 486 and 487 are opened and closed by a right and left thread, which is operated by one thumbnut situated between the shanks of the instrument; this thread also holds the points rigidly and doubles the speed of the screw.

486K. Steelspring Bow Pen, central thumbnut, **Knife Spring Pen,** Needle Point, nickel silver Handle, $3\frac{3}{4}$ in., ... each $

The Knife Spring Paragon Bow Pens have a hinged upper blade actuated by a spring similar to a pocket knife, which either holds the pen open at 90 degrees or presses it firmly against the fixed blade.

Opening the pen for cleaning does not change the adjustment for width of line.

For illustration of Knife Spring Pen, see page 68.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.

PARAGON DOTTING INSTRUMENT AND BEAM COMPASS

For Circles and Straight Lines.

Illustration ½ size.

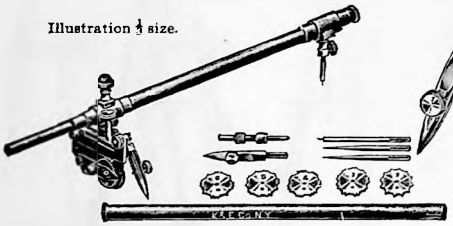
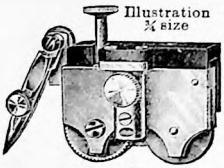


Illustration ¾ size



Dotting Pen with attached finger piece.

For Circles — No. 491. — For Straight Lines

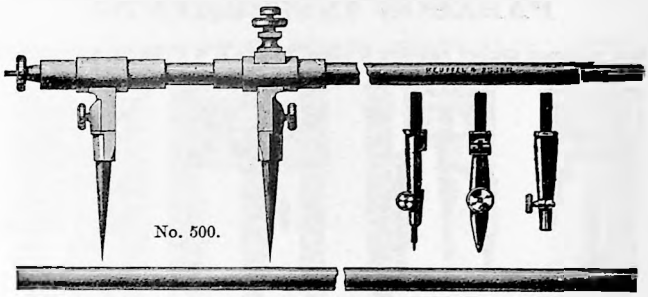
491. Paragon Dotting Instrument, nickel silver, 12 in., 2 Round Bars, Dotting Pen, Pen and Pencil Points, (the Pen Points have Spring Blade) 2 Steel Needle Points, 1 Shouldered Needle for use with Dotting Pen, 1 Shouldered Needle for use with Pen or Pencil Point, Micrometer Adjustment. In velvet lined morocco Case, with bar lock . . . . . each $

This instrument for drawing dotted circles and straight lines is of practical construction and does good work. The propelling and supporting wheels of the dotting pen travel on the drawing and are, therefore, not so liable to slip as those which travel on a straightedge. For dotting circles, the dotting pen is clamped to the bar; for dotting straight lines, along a straightedge, there is a finger piece, for attachment to the dotting pen; this also serves as a handle.

There are 6 ratchet wheels which are readily interchangeable by lifting the flat spring which holds them on their pivots. They produce the following patterns:



Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 500.

500. Tubular Beam Compasses, 18 in., 2 round nickel silver Bars, 2 Steel Points, Pen, Pencil and Needle Point, Micrometer Adjustment . . . . . each $

501. do. do. do. do. 27 in., 3 Bars "

502. do. do. do. do. 38 " 3 " "

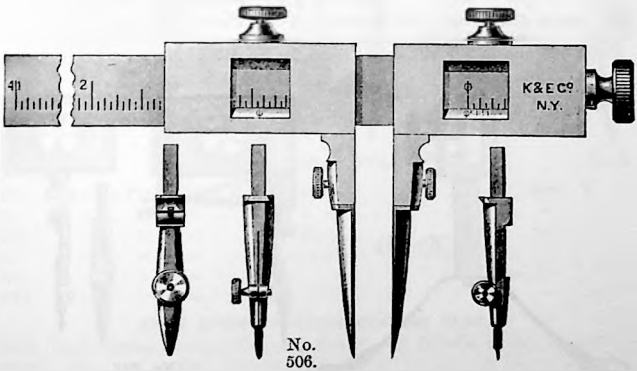
The bar of No. 502 is heavier than those of the smaller sizes.

503. Wheel Attachment for No. 500 or 501 . . . . . "

504. " " " " 502 . . . . . "

Morocco Case, silk velvet lined, for No. 500, 501, 502, each $

do. do. do. if with No. 503 or 504 add

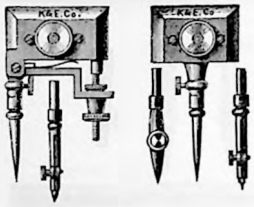


No. 506.

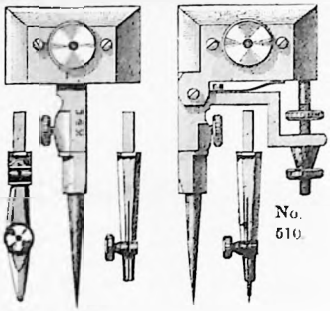
506. Beam Compasses with Rectangular Tubular Bar of nickel silver, Pen, Pencil and Needle Point, 2 Steel Points, Wheel Attachment, Micrometer Adjustment. Bar 44 in. long, divided to $\frac{1}{10}$ inch and by vernier to $\frac{1}{100}$ inch; and 1 meter to millimeters and by vernier to $\frac{1}{10}$ millimeter. Instrument in polished mahogany Case . . . . . each $

PARAGON INSTRUMENTS.

Each Instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 509.

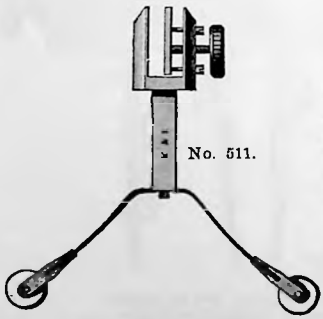


No. 510.

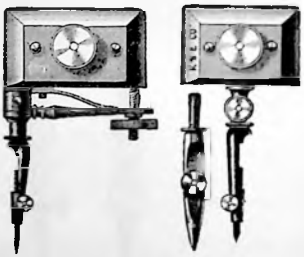
509. Minute Beam Compasses with 2 Steel Points, Pen, Pencil and Needle Point, Micrometer Adjustment . . . . . each $

509½. Wheel Attachment for No. 509 (for illustration see No. 511) "
Morocco Case, silk velvet lined, for No. 509 . . . . . "
do. do. " " " " " 509 and No. 509½ "

510. Beam Compasses with 2 Steel Points, Pen, Pencil and Needle Point, Micrometer Adjustment . . . . . "
Morocco Case, silk velvet lined, for No. 510 . . . . . "



No. 511.



No. 514.

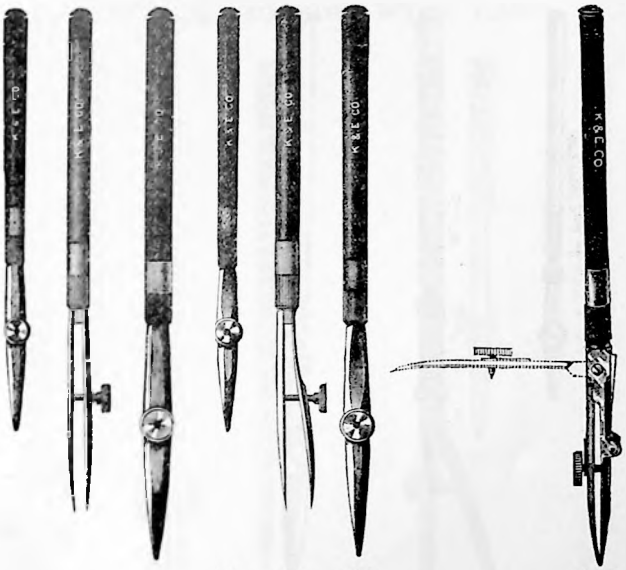
511. Wheel Attachment for No 510 . . . . . each $
Morocco Case, silk velvet lined, for No. 510 and No. 511 "

514. Beam Compasses, to fit on a bar or straightedge, with Pen, Spring Blade, Pencil, fixed Needle Point and Micrometer Adjustment . . . . . "

For Wooden Bars for Beam Compasses, see page 157.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 520. 521. 521½. 522. 523. 523½. 524 K.

520.	Drawing Pen. Ebony Handle, 4½ in.	each	$
521.	" " " " 5 "	"	
521½.	" " " " 5½ "	"	
522.	" " " " upper blade with spring, 4½ in.	"	
523.	" " " " " " " " " 5 "	"	
523½.	" " " " " " " " " 5½ "	"	

KNIFE SPRING PARAGON DRAWING PENS.

522K.	Knife Spring Paragon Drawing Pen, Ebony Handle, 4½ in..	each	$
523K.	do. do. do. do. do. " " 5 "	"	
524K.	do. do. do. do. do. " " 5½ "	"	

The Knife Spring Paragon Bow Pens have a hinged upper blade actuated by a spring similar to a pocket knife, which either holds the pen open at 90 degrees or presses it firmly against the fixed blade.

Opening the pen for cleaning does not change the adjustment for width of line.

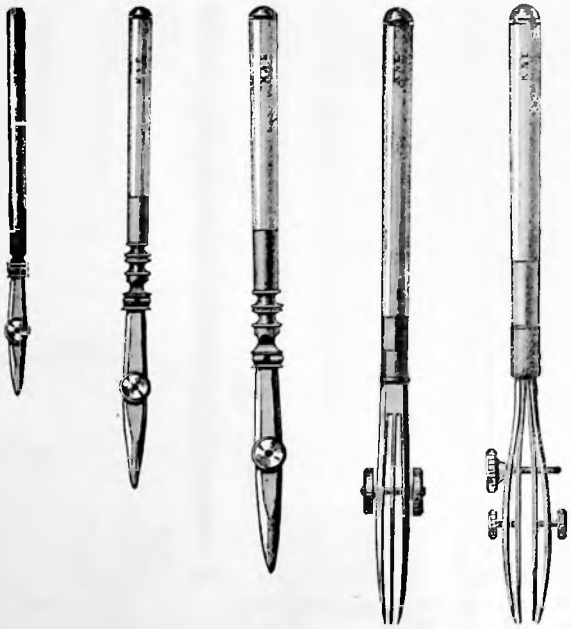
Above Pens with Aluminum Handle, are furnished at the same prices.

Drawing Pens carefully set and sharpened . . . . . each $

For Patent Paragon Pens, see page 69.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 526. 527. 528. 535. 536.

526. Drawing Pen with Joint, Ivory Handle, 4 in. . . . . each $

527. " " " " and Pin, Ivory Handle, 5 in. . . . "

528. " " " " " " " " 5½ " . . . "

530. " " " " " " " " nickel silver blades, for red ink, 5½ " . . . "

535. Border Pen, for broad lines, Ivory Handle . . . 6½ " . . . "

536. " " " " " " " " improved 6½ " . . . "

Above pens with Aluminum Handle, are furnished at the same prices.

Border Pen No. 536 may be used also as Railroad Pen by filling only the two pairs of blades with ink.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.

PATENT PARAGON DRAWING PENS.



No. 537. 538. 539.

537. Click Paragon Drawing Pen, Patented, Ebony Handle, 4½ in., each $
538. do. do. do. do. " " " 5 " "
539. do. do. do. do. " " " 5½ " "

Above pens with Aluminum Handle, are furnished at the same prices.

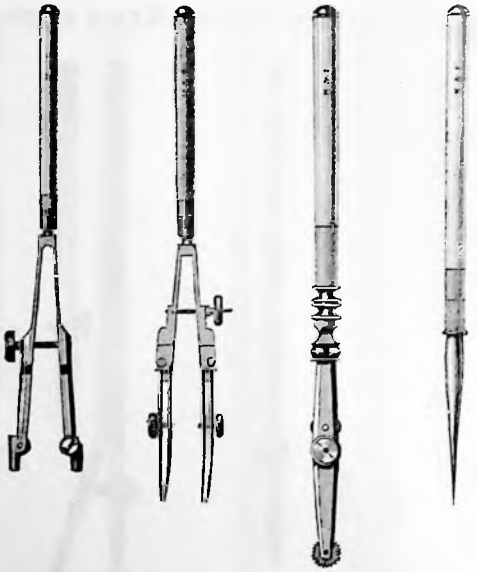
The Click Patent Paragon Drawing Pens possess all the excellent qualities which have made our Paragon Pens famous. In addition they can be returned to their exact original setting after having been opened (for cleaning) while at work on a drawing.

In the Click Pens Nos. 537 to 539 the lug bearing the thread for the thumb nut ends in a steel hook which passes through a slot in the other blade, and is kept in place by a spring. The pen is opened by pushing the hook off its bearing, and is restored to its original setting by pressing the blade down, when the hook catches automatically.

Drawing Pens carefully set and sharpened . . . . . each $

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 543. 545. 551. 556.

543. Railroad Pencil, Ivory Handle, 5 in. . . . . each $

545. Railroad Pen with Joints to blades and in shanks, K & E improved, Ivory Handle, 5 in. . . . . "

The improvement consists in having both pens bent in the same direction, so that lines can be drawn against a straightedge or rule as readily as with a ruling pen.

551. Dotting Pen with 6 Wheels, Ivory Handle, improved. 6 in. "

The improved Dotting Pen No. 551, is doubtless the best pen for the purpose, as it entirely prevents blotting, provided the ink be not too thin. The reservoir, after being filled, is closed and supplies no more ink to the dotting wheel than is actually required.

556. Tracer. Ivory Handle 5 in. . . . . "

Above instruments with Aluminum Handle, are furnished at the same prices.

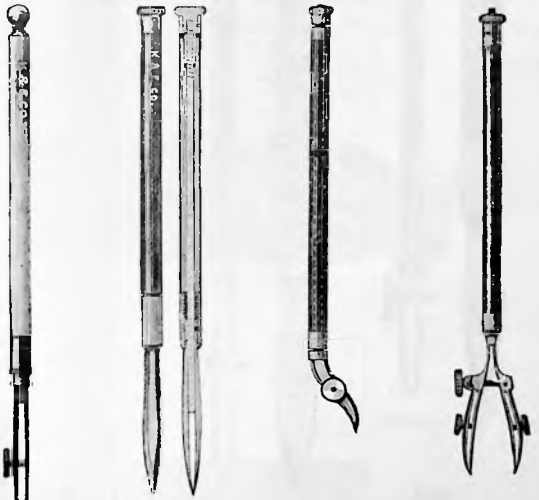
For Nos. 601 to 612 see pages 53-55.

Drawing Pens carefully set and sharpened . . . . . each $

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. CO., N. Y. Paragon.

IMPROVED DRAWING PENS.



No. 690. 695. 696. 697.

690. Hatching Pen, extra fine, with Pushing Screw, 6 in. . . each $

695. Improved Drawing Pen, $5\frac{1}{2}$ in., without thumb screw . . "

This pen opens and closes by turning the set screw at the upper end of the handle—a decided improvement on the screw through the blades arrangement—preventing displacement of the nibs sideways. As there is no obstruction to the sight in working, this pen is preferable for fine work.

696. Improved Curve Pen, $4\frac{3}{4}$ in., spring blade . . . . . each $

This pen has a hollow handle in which a thin rod rotates. The blades being fastened to the end of the rod and being eccentric to it, turn easily and follow the smallest curve with precision. By means of a nut at the upper end of the rod, the pen can be clamped and may then be used as a regular drawing pen.

697. Improved Railroad Pen, $5\frac{1}{4}$ in., spring blades . . . . . each $

The construction of this pen is like that of No. 696 with the exception that it has two pairs of blades.

These improved pens have been extensively imitated in inferior qualities. Insist upon obtaining the Paragon brand.

Drawing Pens carefully set and sharpened . . . . . each $

Each Instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 558–1. 558–2. 558–3.

558–1. Detail Drawing Pen, 5 in., upper blade with spring, flat Ebony Handle . . . . . each $

558–2. do. do. 6 in. do. . . . . "

558–3. do. do. 7 " do. . . . . "

Above pens, with Aluminum Handle, are furnished at the same prices.



No. 559.

559. Fine nickel silver Lead Box, screw cap, containing 6 leads . . . . . each $

601 &c. Dividers, Compasses with Esser's Patent Joint, see page 53.

Drawing Pens carefully set and sharpened . . . . . each $

PARAGON INSTRUMENTS

WITH

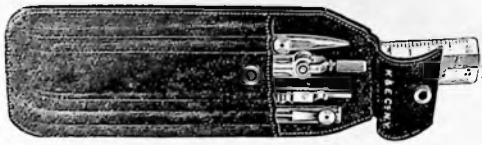
ESSER'S PATENT PIVOT JOINT.

IN MOROCCO POCKET CASES, SILK VELVET LINED.

SETS OF ANY OTHER COMBINATION FURNISHED TO SUIT THE PURCHASER.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.

The Compasses in these sets are listed with **insertion pieces with pentagonal shank** (with thumbscrew). We furnish them, also, with the **insertion pieces with round shank and spring socket** (without thumbscrew) at the same price, if the compass is listed separately in that form.

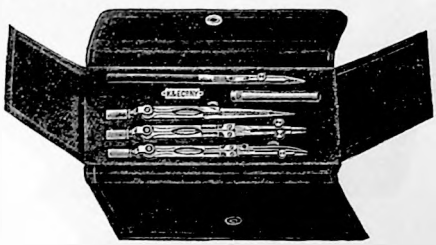


No. 619.

619. Vest Pocket Set, **sewed leather Pouch**, about $2\frac{1}{2} \times 7$ in., with flap and button catch, containing:-

1 Compasses $6\frac{1}{2}$ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 610,
1 Drawing Pen, Ebony Handle, 5 in., upper blade with spring, No. 523,
1 Paragon Scale 6 in., 10, 30, 40 and 50 parts to the inch, No. 1419 P. . . . . each $

The pouch also contains compartments for a pencil and a fountain pen. These are not covered by the flap, and therefore, are readily accessible.



No. 621 H.

621 H. Pocket Case with **folding flaps** containing:-

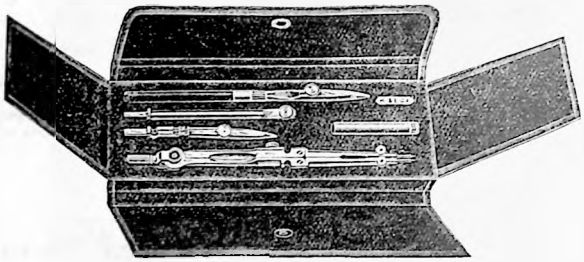
1 Compasses, $4\frac{1}{2}$ in., with fixed Needle Point with Hairspring and Pen Point, No. 604 H,
1 Compasses, $4\frac{1}{2}$ in., with fixed Needle Point with Hairspring and Pencil Point, No. 605 H,
1 Hairspring Divider, 4 in., No. 601,
1 Drawing Pen, Ebony Handle, $4\frac{1}{2}$ in., upper blade with spring, No. 522,
1 Nickel silver Box with Leads, No. 559 . . . each $

Above Sets in Pocket Case with Bar lock furnished at same price.

For empty cases for instruments, see page 99.

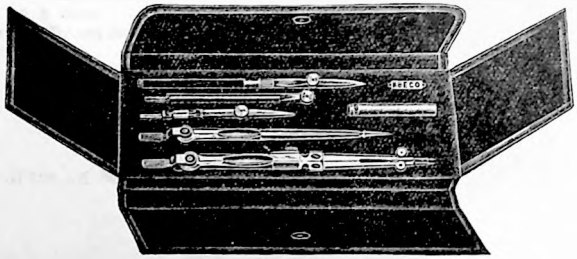
PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 622-1.

622-1. Pocket Case with folding flaps, containing:-
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar No. 610,
1 Drawing Pen, Ebony Handle, 5 in., upper blade, with spring, No. 523,
1 Nickel silver Box with Leads, No. 559 . . . . . each $



No. 622-2.

622-2. Pocket Case with folding flaps, containing same assortment as No. 622-1, but with addition of 1 Plain Divider, 5¾ in., No. 606 . . . . . each $

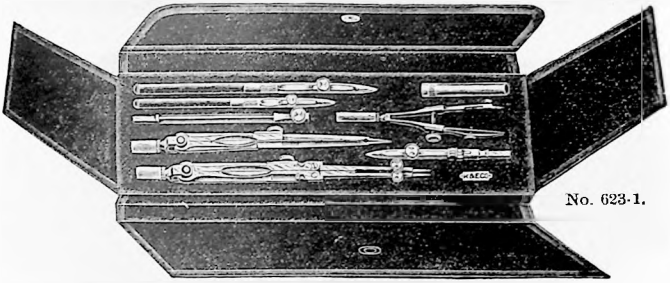
Above Sets in Pocket Case with Bar lock furnished at the same price.

See note at top of page 73, Insertion pieces with round shank (no thumbscrew).

For empty cases for instruments, see page 99.

PARAGON INSTRUMENTS.

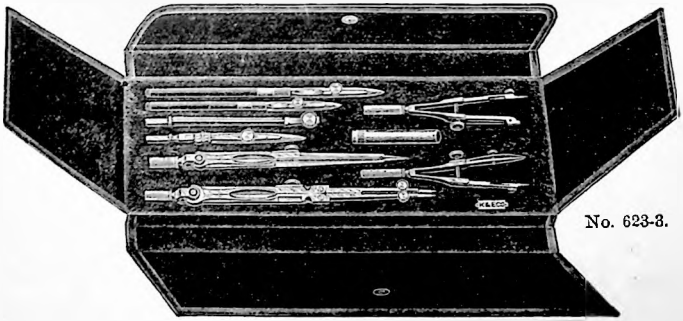
Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 623-1.

623-1. Pocket Case with folding flaps, containing:-
1 Compasses, 6¼ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 610.
1 Hairspring Divider, 5¾ in., No. 608,
1 Steelspring Bow Pen, No. 481,
1 each Drawing Pen, Ebony Handle 4½ in., 5½ in. upper blade with spring, Nos. 522, 523½,
1 Nickel silver Box with Leads, No. 559 . . . . each $

623-1 C. Pocket Case with folding flaps, containing same assortment as No. 623-1, but with Bow Pen No. 486 (with central thumbnut) in place of No. 481. "



No. 623-3.

623-3. Pocket Case with folding flaps, containing same assortment as No. 623-1, but with addition of 1 Steelspring Bow Pencil, No. 482 . . . . . each $

623-3 C. Pocket Case with folding flaps, containing same assortment as No. 623-3, but bows Nos. 486, 487 (with central thumbnut) in place of Nos. 481, 482 . . . "

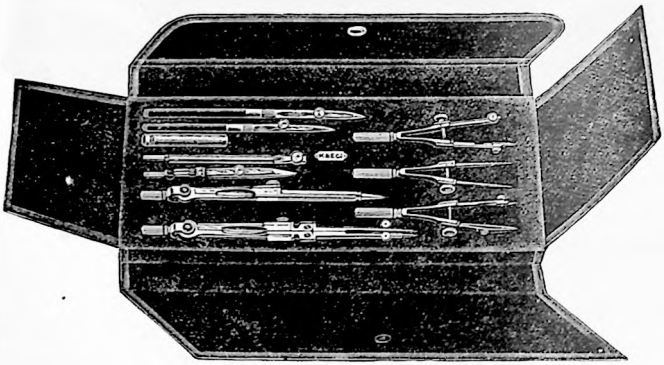
Above Sets in Pocket Case with Bar lock furnished at same price.

See note at top of page 73, Insertion pieces with round shank (no thumbscrew)

For empty cases for Instruments, see page 99.

PARAGON INSTRUMENTS.

Each Instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 624.

624. Pocket Case with folding flaps, containing:-

1 Compasses. 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 610.

1 Hairspring Divider, 5¾ in., No. 608,

1 Steelspring Bow Divider, 3¾ in. No. 480,

1 do. Bow Pen, 3¾ " 481,

1 do. Bow Pencil, 3¾ " 482,

1 Drawing Pen, Ebony Handle, 4½ in., upper blade with spring, No. 522,

1 Drawing Pen, Ebony Handle, 5½ in., upper blade with spring, No. 523½,

1 Nickel silver Box with Leads, No. 559. . . . . each $

624C. Pocket Case with folding flaps, containing same assortas No. 624, but with Spring Bows Nos. 485, 486, 487, (central thumbnut) in place of Nos. 480, 481, 482 . . . . . "

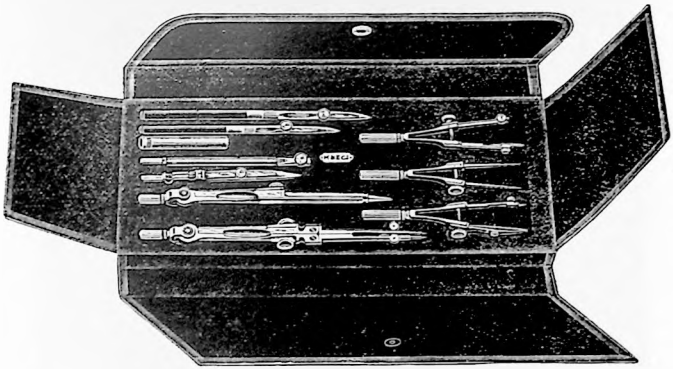
Above Sets in Pocket Case with Bar-lock furnished at same price.

See note at top of page 73, Insertion pieces with round shank (no thumbscrew).

For empty cases for instruments, see page 99.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 624 H.

624 H. Pocket Case with folding flaps, containing:-

1 Compasses, 6½ in., fixed Needle Point with Hairspring, Pen, Pencil Point and Lengthening Bar, No. 610 H,

1 Hairspring Divider, 5¾ in., No. 608,

1 Steelspring Bow Divider, 3¾ in., No. 480.

1 do. Bow Pen, 3¾ " 481.

1 do. Bow Pencil, 3¾ " 482.

1 Drawing Pen, Ebony Handle, 4½ in., upper blade with spring, No. 522.

1 Drawing Pen, Ebony Handle, 5½ in., upper blade with spring, No. 523½.

1 Nickel silver Box with Leads, No. 559 . . . . . each $

624 HC. Pocket Case with folding flaps, containing same assortment as No. 624 H, but with Spring Bows Nos. 485, 486, 487 (central thumbnut) in place of Nos. 480, 481, 482 . . . . . "

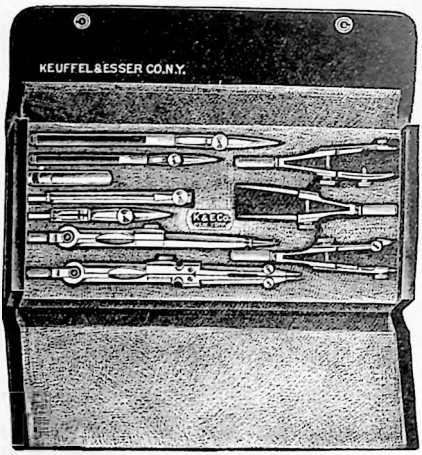
Above Sets in Pocket Cases with Bar-lock furnished at same price.

See note at top of page 73, Insertion pieces with round shank (no thumbscrew).

For empty cases for instruments, see page 99.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 624 A.

624 A. Improved Pocket Case, with folding covers and pocket, containing:-

1 Compasses, 6¼ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 610.

1 Hairspring Divider, 5¾ in., No. 608.

1 Steelspring Bow Divider, 3¾ in., No. 480,

1 do. Bow Pen, 3¾ " 481,

1 do. Bow Pencil, 3¾ " 482,

1 Drawing Pen, Ebony Handle 4½ in., upper blade with spring, No. 522,

1 Drawing Pen, Ebony Handle, 5½ in., upper blade with spring, No. 523½,

1 Nickel silver Box with Leads, No. 559 . . . . each $

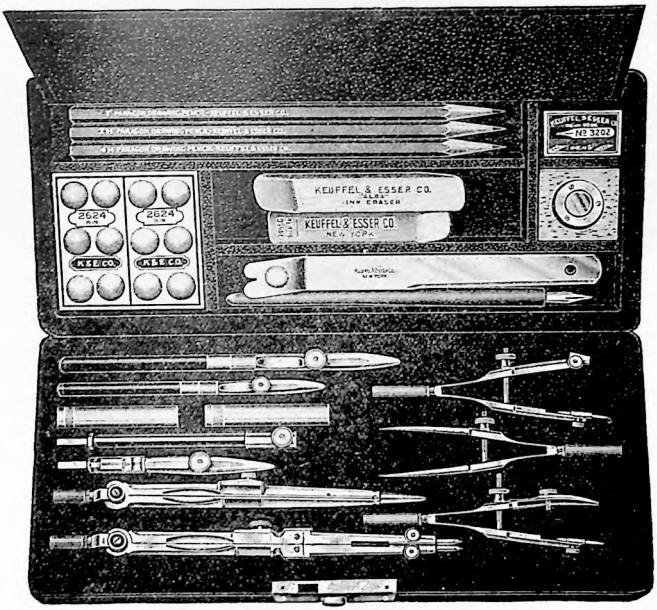
624 AC. Improved Pocket Case, with folding covers and pocket, containing same assortment as No. 624 A, but with Spring Bows Nos. 485, 486, 487 (with central thumbnut) in place of Nos. 480, 481, 482 "

See note at top of page 73, insertion pieces with round shank (no thumbscrew).

For empty cases for instruments, see page 99.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 624 D.

624 D. Morocco Case with recessed and partitioned lid with hinged cushion. The lid is arranged for holding pencils, pen holders, pens, tacks, tack lifter, rubber, etc.; (which are shown in cut No. 624 D, but are not included in price), containing:

1 Compasses, 6¼ in., fixed Needle Point with Hair-spring, Pen, Pencil Point and Lengthening Bar, No. 610 H,
1 Hairspring Divider, 5¾ in., No. 608,
1 Set Steelspring Divider and Bows, 3¾ in., Nos. 480, 481, 482,
1 each Drawing Pen, Ebony Handle, 4½ in., 5½ in., Nos. 522, 523½,
1 Nickel silver Box with Leads, No. 559 . . . . each $

624½ D. Morocco Case with recessed lid containing same assortment as No. 624 D, but with addition of 1 Detail Drawing Pen, 6 in., upper blade with spring, flat Ebony Handle No. 558-2 . . . . "

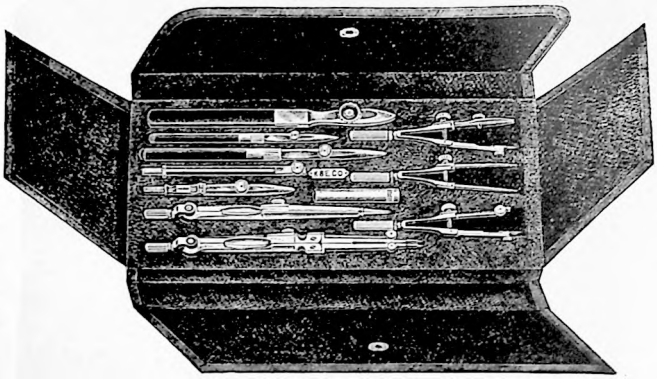
Above Sets with Spring Bows Nos. 485, 486, 487, (central thumbnut) in place of Nos. 480, 481, 482, add . . . . . per set $

See note at top of page 73, Insertion pieces with round shank (no thumbscrew).

For empty cases for instruments, see page 99.

PARAGON INSTRUMENTS.

Each Instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. 624½.

624½. Pocket Case with folding flaps, containing:-

1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 610.
1 Hairspring Divider, 5¾ in., No. 608.
1 Steelspring Bow Divider, 3¾ in. No. 480.
1 do. Bow Pen, 3¾ " 481.
1 do. Bow Pencil, 3¾ " 482.
1 Drawing Pen, Ebony Handle, 4½ in., upper blade with spring, No. 522.
1 Drawing Pen, Ebony Handle, 5½ in., upper blade with spring, No. 523½.
1 Detail Drawing Pen, flat Ebony Handle 6 in., upper blade with spring, No. 558-2.
1 Nickel silver Box with Leads, No. 559 . . . each $

624½C. Pocket Case with folding flaps, containing same assortment as No. 624½, but with Spring Bows Nos. 485, 486, 487. (central thumbnut) in place of Nos. 480, 481, 482 . . . . . "

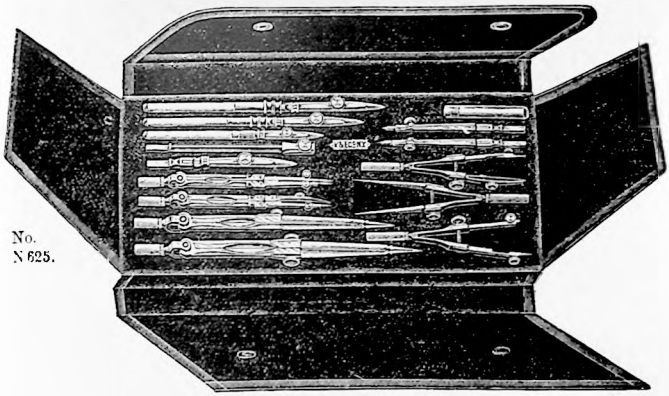
Above Sets in Pocket Case with Bar lock furnished at same price.

See note at top of page 73, Insertion pieces with round shank (no thumbscrew)

For empty cases for Instruments, see page 99.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



No. N 625.

N 625. Pocket Case, with folding flaps, containing:-

1 Compasses, 6½ in., with 2 Steel Points, Pen, Pencil, Needle Point and Lengthening Bar, No. 612.
1 Compasses 4½ in., fixed Needle and Pen Point, No. 604 H,
1 do. 4½ " " " " Pencil " " 605 H,
1 Hairspring Divider, 5¾ in., No. 608,
1 Steelspring Bow Divider, 3¾ in., No. 480,
1 do Bow Pen, 3¾ " 481,
1 do. Bow Pencil, 3¾ " 482,
1 Drawing Pen with Joint, Ivory Handle, 4 in., No. 526,
1 Drawing Pen with Joint and Pin, Ivory Handle, 5 in., No. 527,
1 Drawing Pen with Joint and Pin, Ivory Handle, 5½ in., No. 528,
1 Nickel silver Box with Leads, No. 559 . . . . . each $

N 625 C. Pocket Case with folding flaps containing same assortment as No. N 625 but with Spring Bows, Nos. 485, 486, 487, (central thumbnut) in place of Nos. 480, 481, 482 . . . . . "

Above sets in Pocket Case, with Bar lock, furnished at same price.

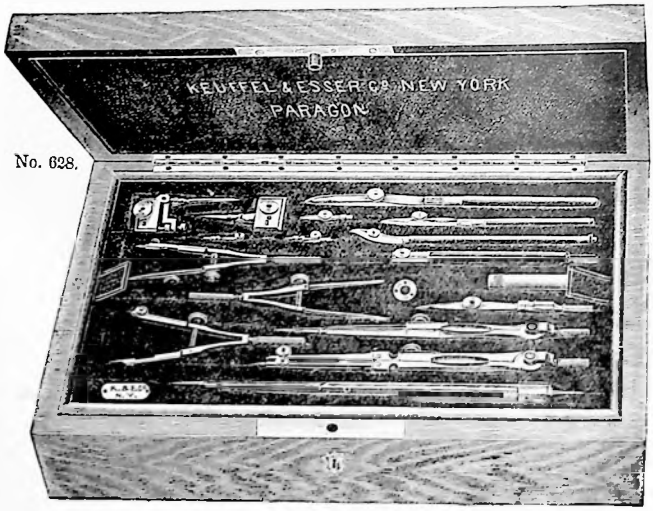
See note at top of page 73, Insertion pieces with round shank (no thumbscrew).

For empty cases for Instruments, see page 99.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.

No. 628.



628. Polished Mahogany Case, Tray lined with Silk Velvet, with Lock, containing:-

1 Compasses, 6¼ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 610,
1 Hairspring Divider, 5½ in., No. 608,
1 Proportional Divider, No. 435,
1 Minute Beam Compass, with 2 Steel Points, Pen, Pencil and Needle Point, No. 509,
1 Steelspring Divider, 3¾ in., No. 480,
1 do. Bow Pen, 3¾ " 481,
1 do. Bow Pencil, 3¾ " 482,
1 Drawing Pen, Ebony Handle, 4½ in., upper blade with spring, No. 522,
1 Drawing Pen, Ebony Handle, 5½ in., upper blade with spring, No. 523½,
1 Improved Curve Pen, 4¾ in., No. 696,
1 Horn Center with nickel silver Rim, No. 2691,
1 Nickel silver Box with Leads, No. 559 . . . . . each $

Size of tray 6×10 in.: space under tray ¾ in. high.

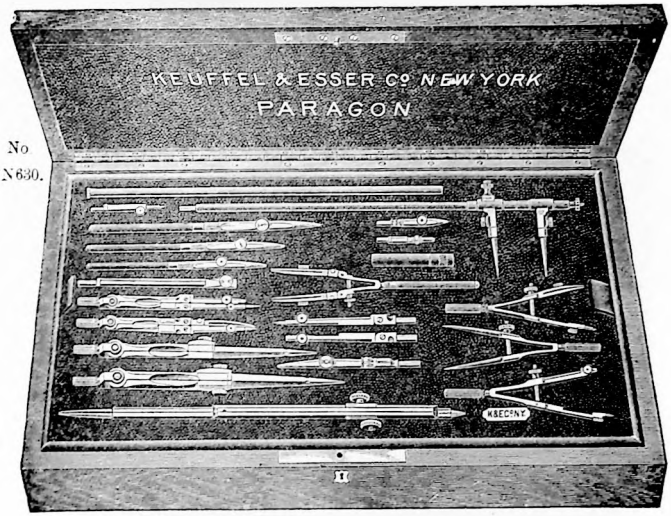
628 C. Above set with spring bows, Nos. 485, 486, 487, (central thumbnut) in place of Nos. 480, 481, 482, . . . add "

See note at top of page 73, Insertion pieces with round shank (no thumbscrew).

For empty cases for instruments, see page 99.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.



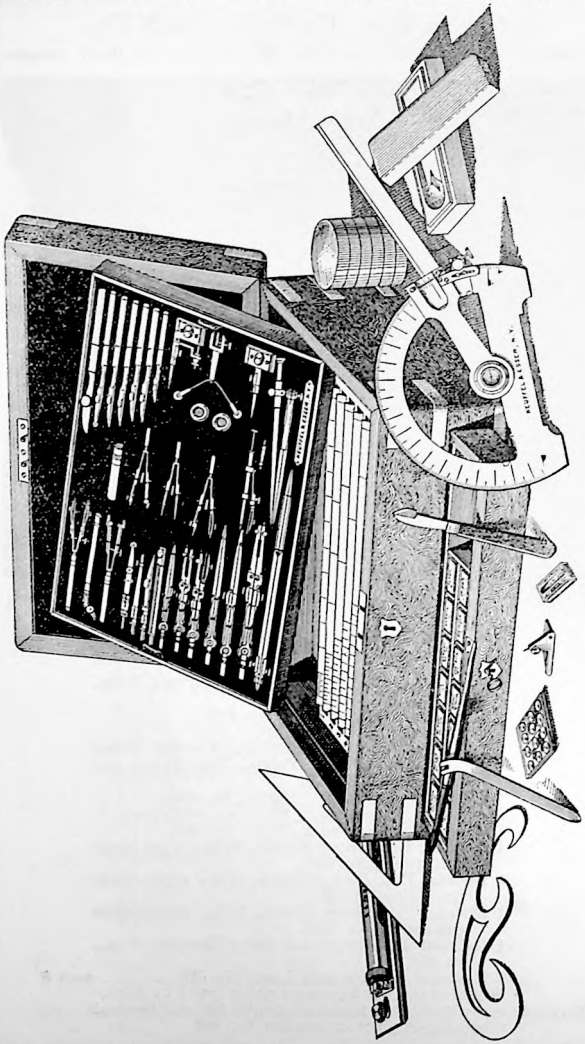
No N630.

N630. Polished Mahogany Case, Tray lined with Silk Velvet, with Lock, cont'g:-

1 Compasses, 6½ in., with 2 Steel Points, Pen, Pencil, Needle Point and Lengthening Bar, No. 612,
1 Compasses, 4½ in., fixed Needle and Pen Point, No. 604H.
1 Compasses, 4½ in., fixed Needle and Pencil Point, No. 605H.
1 Hairspring Divider, 5¾ in., No. 608,
1 Proportional Divider, No. 437,
1 Tubular Beam Compass, 27 in., 3 round nickel silver Bars, 2 Steel Points, Pen, Pencil and Needle Point, No. 501.
1 Steelspring Divider; 3¾ in., No. 480,
1 " Bow Pen, 3¾ " 481,
1 " Bow Pencil, 3¾ " 482,
1 Drawing Pen, Ebony Handle, 4½ in., upper blade with spring, No. 522,
1 Drawing Pen, Ebony Handle, 5 in., upper blade with spring, No. 523,
1 Drawing Pen, Ebony Handle, 5½ in., upper blade with spring, No. 523½,
1 Railroad Pen, improved, Ivory Handle, 5 in., No. 545,
1 Nickel silver Box with Leads, No. 559 . . . . . each $
Size of tray 7×13 in.; space under tray ¾ in. high.

N630C. Above set with spring bows, Nos. 485, 486, 487 (central thumbnut) in place of Nos. 480, 481, 482, . . . add "

See note at top of page 73. Insertion pieces with round shank (no thumbscrew). For empty Cases for Instruments, see page 99.



No. N 633.

PARAGON INSTRUMENTS.

Each instrument stamped KEUFFEL & ESSER CO., or K. & E. CO., N. Y. Paragon.

N633. Fine polished Mahogany Case, with Tray lined with Silk Velvet, Drawer nickel silver Bands and Corners, with Lock, (see illustration) containing:

1 Compasses 6½ in., with fixed Needle Point, with Hairspring, Pen, Pencil Point, Lengthening Bar, Dotting Pen, No. 610 HD,
1 Compasses, 4½ in., with fixed Needle and Pen Point and with Hairspring, 604 H,
1 Compasses, 4½ in., with fixed Needle and Pencil Point and with Hairspring 605 H,
1 Hairspring Divider, 4 in., No. 601,
1 Plain Divider, 5¾ in., No. 606,
1 Hairspring Divider, 5¾ in., No. 608,
1 Three legged Divider, No. 431,
1 Proportional Divider Universal, with movable Points, No. 440
1 Drop Spring Bow Pen and Pencil, No. 454,
1 Set Steelspring Divider and Bows, No. 485, 486K, 487,
1 Beam Compass 510, with Wheel Attachment 511,
1 Drawing Pen, 4½ in., No. 522 K,
2 do. 5 " " 523 K,
2 do. 5½ " " 524 K.
1 Detail Drawing Pen, 6 in., No. 558-2,
1 Railroad Pencil, 5 in., No. 543.
1 Improved Curve Pen, 4¾ in., No. 696.
1 Railroad Pen, 5 in., Ivory Handle, No. 697,
1 Dotting Pen, 6 " " " " 551,
2 Horn Centers with nickel silver rim, No. 2691,
1 Nickel Silver Box with Leads, No. 559,
1 Set (8) Paragon Scales like No. 1576 P,
1 Paper Cutter, No. 2701,
1 Protractor, No. 1228,
1 Nickel Silver Parallel Rule, No. 1751,
2 doz. each Nickel Silver Thumb Tacks, Nos. 2643, 2644,
1 Tacklifter, No. 2680,
1 each Xylonite Triangle, No. 1855, 6, 8, 12 in.,
1 " " " " 1856, 4, 7, 10 "
1 " " Curve, " 1860, 4, 13, 19 "
1 Set of 18 Full Pans W. & N. Colors, Nos. 2920-2923,
1 Cake Chinese Ink, No. 3031 V,
1 doz. assorted Camel Hair Brushes, No. 3102,
1 each black Sable Brush, No. 3120, 1, 2, 6, 10, 14, 18,
1 " Camel Hair Brush, No. 3136, 1, 2, 3,
1 Patent Ink Slab, No. 3150,
1 Nest of Saucers, No. 3161,
1 doz. Lettering Pens, No. 3202, with Holder,
3 doz. Artist Pencils, No. 3383,
3 Boxes Leads, No. 3385,
1 Cake Pliable Rubber, No. 3452-8,
2 Cakes Alba Rubber, No. 3455 G-24,
2 " Ink Eraser, No. 3418, 3419,
1 Steel Eraser, No. 3481,
1 Pencil Pointer, No. 3507, ... each $

ANCHOR AND PILOT DRAWING INSTRUMENTS.

Made in the United States.



A view of the assembling room of the Drawing Instrument Department of our Factory.

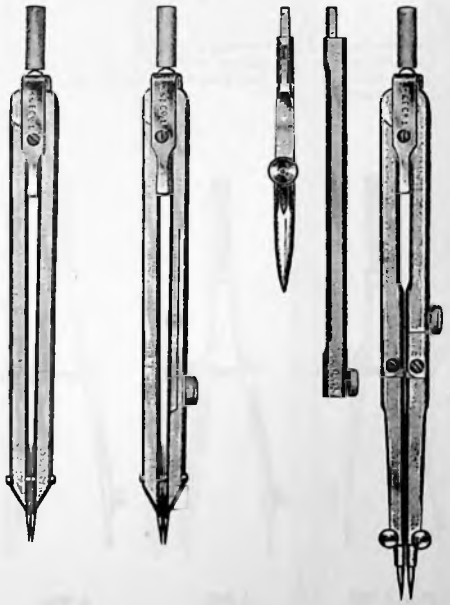


A view of the grinding room of the Drawing Instrument Department of our Factory.

ANCHOR DRAWING INSTRUMENTS.

Each instrument stamped with trade mark ⚓ and K & E Co.

The head of the Anchor Compasses is of the pivot joint type with approved straight-ruling device for maintaining the vertical position of the handle. The various interchangeable parts have the pentagonal shank and socket, as in our Paragon Instruments. The different parts are numbered serially for identification.



No. A 646. A 648. A 650.

A 646. Plain Divider, $5\frac{1}{4}$ in. . . . . each $

A 648. Hairspring Divider, $5\frac{3}{4}$ in. . . . . "

A 650. Compasses, $6\frac{1}{2}$ in., with fixed Needle and Pencil Point, Pen and Lengthening Bar . . . . . "

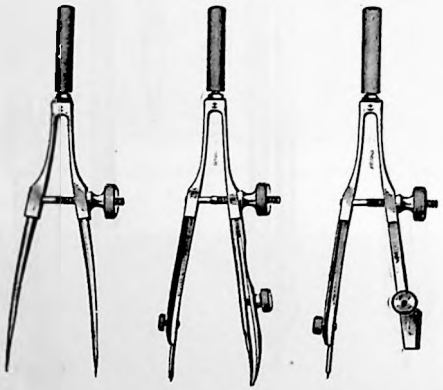
ANCHOR

DRAWING INSTRUMENTS.

Made in U. S. A.

Each instrument stamped with trade mark ⚓ and K & E Co.

Anchor Bows are designed on the exact type of our well-known Paragon all-steel spring bows. They are made of the highest grade of tool steel manufactured especially for the purpose. An elaborate heat treating equipment with temperature control insures proper hardness and temper of each part.



No. A 660. A 661. A 662.

A 660. Steelspring Bow Divider, 3½ in., nickel silver Handle . . each $8

A 661. Steelspring Bow Pen, Spring Blade, 3½ in., with Needle Point, nickel silver Handle . . . . . "

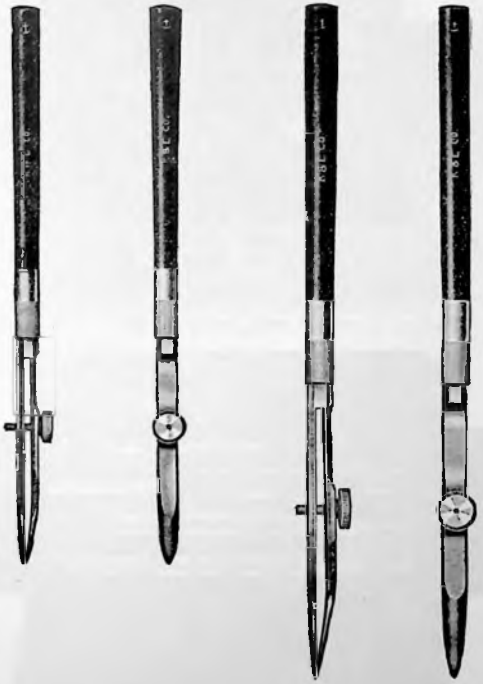
A 662. Steelspring Bow Pencil, 3½ in., with Needle Point, nickel silver Handle . . . . . "

ANCHOR
DRAWING INSTRUMENTS.

Made in U. S. A.

Each instrument stamped with trade mark ⚓ and K & E Co.

These pens are of hexagonal shape, the nibs accurately set and ground. The highest grade of steel is used; as in the manufacture of the Anchor Bows, the hardening process is given special attention.



No. A 672. A 674.

A 672. Drawing Pen, upper blade with spring, 4½ in. . . . . each $

A 674. Drawing Pen, upper blade with spring, 5½ in. . . . . "

559. Fine nickel silver Lead Box, screw cap containing 0 leads. "

For illustration of No. 559, see page 72.

Drawing Pens carefully set and sharpened . . . . . each $

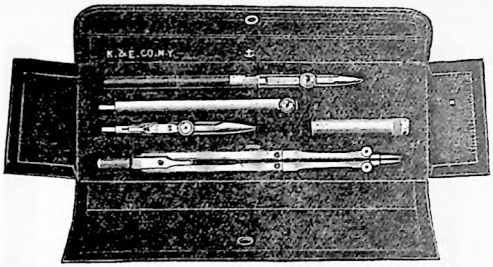
ANCHOR

DRAWING INSTRUMENTS.

Made in U. S. A.

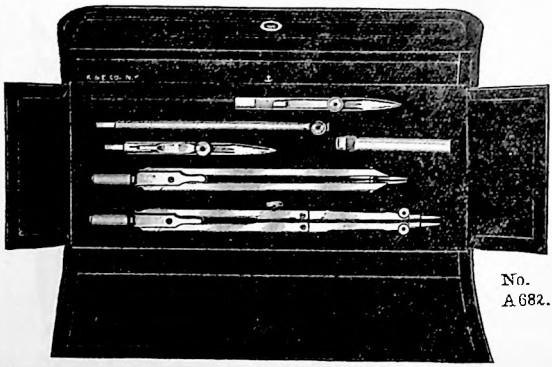
Each instrument stamped with trade mark ⚓ & K & E Co.

In Fine Morocco Pocket Cases, Silk Velvet Lined.



No. A 680.

A 680. Pocket Case with folding flaps, containing:-
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. A 650,
1 Drawing Pen, 5½ in., upper blade with spring, No. A 674,
1 nickel silver Box with Leads, No. 559 . . . . . each $



No. A 682.

A 682. Pocket Case with folding flaps, containing:-
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. A 650,
1 Plain Divider, 5¾ in., No. A 646,
1 Drawing Pen, 5½ in., upper blade with spring, No. A 674,
1 Nickel silver Box with Leads, No. 559, ... "

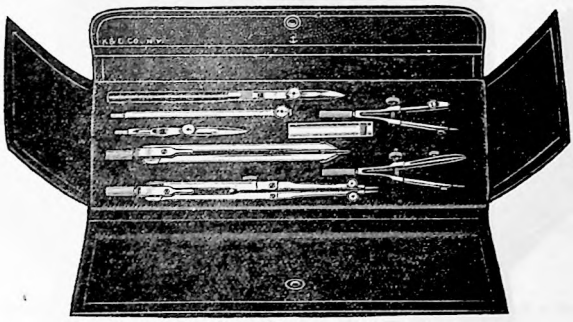
ANCHOR

DRAWING INSTRUMENTS.

Made in U. S. A.

Each instrument stamped with trade mark ⚓ and K & E Co.

In Fine Morocco Pocket Cases, Silk Velvet Lined.



No. 684½.

A 684. Pocket Case with folding flaps, containing:-
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. A 650,
1 Plain Divider, 5¾ in., No. A 646,
1 Steelspring Bow Pen, 3½ in., No. A 661,
1 Drawing Pen, 5½ in., upper blade with spring, No. A 674,
1 Nickel silver Box with Leads, No. 559, ... "

A 684½. Pocket Case with folding flaps, containing:-
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. A 650,
1 Plain Divider, 5¾ in., No. A 646,
1 Steelspring Bow Pen, 3½ in., No. A 661,
1 Steelspring Bow Pencil, 3½ in., No. A 662,
1 Drawing Pen, 5½ in., upper blade with spring, No. A 674,
1 Nickel silver Box with Leads, No. 559, ... each $

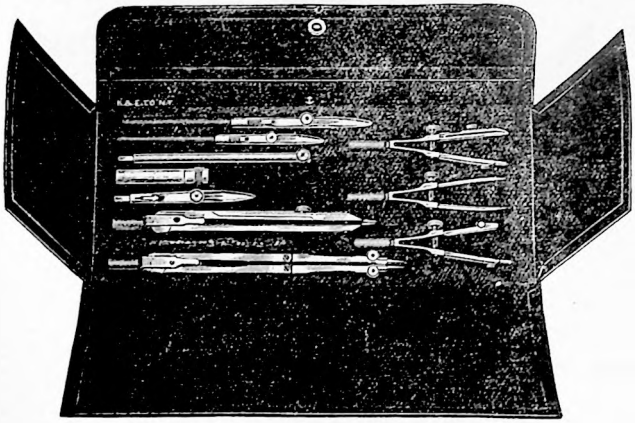
A 685. Pocket Case with folding flaps, containing:-
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening bar, No. A 650,
1 Plain Divider, 5¾ in., No. A 646,
1 Steelspring Bow Pen, 3½ in., No. A 661,
1 Steelspring Bow Pencil, 3½ in., No. A 662,
1 Drawing Pen, 4½ in., upper blade with spring, No. A 672,
1 Drawing Pen, 5½ in., upper blade with spring, No. A 674,
1 Nickel silver Box with Leads, No. 559, ... each $

ANCHOR
DRAWING INSTRUMENTS.

Made in U. S. A.

Each instrument stamped with trade mark ⚓ and K & E Co.

In Fine Morocco Pocket Cases, Silk Velvet Lined.



No. A 686.

A 685½. Pocket Case with folding flaps, containing:-

1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. A 650,
1 Plain Divider, 5¾ in., No. A 646,
1 Steelspring Bow Divider, 3½ in., No. A 660,
1 Steelspring Bow Pen, 3½ in., A 661,
1 Steelspring Bow Pencil, 3½ in., No. A 662,
1 Drawing Pen, 5½ in., upper blade with spring, No. A 674,
1 Nickel silver Box with Leads, No. 559, ... each $

A 686. Pocket Case with folding flaps (illustrated above), containing:-

1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. A 650,
1 Hairspring Divider, 5½ in., No. A 648,
1 Steelspring Bow Divider, 3½ in., No. A 660,
1 Steelspring Bow Pen, 3½ in., No. A 661,
1 Steelspring Bow Pencil, 3½ in., No. A 662,
1 Drawing Pen, 4½ in., upper blade with spring, No. A 672,
1 Drawing Pen, 5½ in., upper blade with spring, No. A 674,
1 Nickel silver Box with Leads, No. 559, ... "

MINUSA
TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

When the great war suddenly shut off the usual sources of supply, we began the manufacture of drawing instruments in our factories in Hoboken. Encouraged by the success of our first efforts, we created a special department, with the most modern machinery and equipment, which enabled us to make all parts of these instruments under our own supervision. This special department has since grown into a complete factory employing a large number of workmen who are specialists in the art of making drawing instruments.

In the process of development, the designs of these instruments have been constantly changing, due to suggestions made by professional draftsmen and as a result of our own endeavors to design instruments which could be manufactured by the most up-to-date American methods. In the production of

MINUSA DRAWING INSTRUMENTS

we have finally succeeded in turning out a high-grade instrument at a minimum cost.

These instruments embody high quality, graceful design, perfect balance, fine finish and practicability, and yet are not hand-made, but manufactured by automatic machinery. Exact uniformity of each part of these instruments has been obtained by the use of jigs and tools of great precision; we are, therefore, able to furnish machine-made instruments in which all parts are interchangeable.

We have established the manufacture of drawing instruments as an essential American industry, but continuance of the line in American hands is dependent upon the support and co-operation of the American draftsman and student.

MINUSA COMPASSES.



Fig. 1.

The cylindrical shape of the Minusa Compasses and Dividers most readily conforms to that of the hand, and those working with drawing instruments during long periods find that they can use this type of instrument with the least discomfort. The instruments are light and extremely rigid, graceful

MINUSA
TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

in appearance and well balanced; the material used in their construction (the finest quality of nickel silver) is of a high degree of density and hardness. As all these instruments are finished with a grained finish, they have not the glossy, cheap appearance which is produced by the Buffing Wheel on low priced inferior drawing instruments. The beauty of the design of the instrument is shown in the illustration, but its perfect balance can only be appreciated by actual use.

An important feature of these compasses is the method of inserting the various detachable parts; we have adhered to the pentagonal shank and socket as illustrated in Figure 2.



Fig. 2.

The pentagonal shank engages in a socket of the same shape and is held in place by a set screw which presses the bevelled part of the shank into the corresponding V groove in the socket. This construction, besides ensuring a positive alignment when the parts are inserted, gives the leg an unbroken line which enhances the appearance of the instrument. Owing to the exactness of our manufacturing processes, these various parts are all interchangeable, and should any be lost can be replaced without trouble.

Another important feature is the method of clamping the lead and needle point.



Fig. 3.

Figure 3 shows this well designed construction, which gives a firm grip on the lead without danger of breakage and affords an easy adjustment for setting the lead and needle point to the same length. Other forms of construction expose the lead to the liability of breakage, or in cases where the contact surface is small, the lead may slip no matter how tightly it may be clamped.

KEUFFEL & ESSER CO. NEW YORK

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DRAWING INSTRUMENTS.

Made in the U. S. A.

The illustrations (Figures 4 and 5) show the importance of having a knee-joint in each leg. Figure 5 shows, how, at any spread of the compass, the needle-leg and pencil-leg (or pen) may be set perpendicularly to the paper, thereby giving the instrument a symmetrical appearance and perfect balance. By way of contrast, an instrument with a knee-joint in one leg only, is shown in Figure 4.

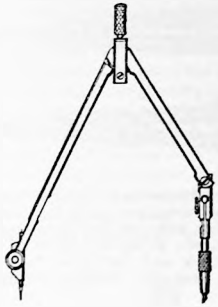


Fig. 4.

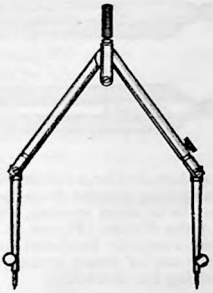


Fig. 5.

The construction of the knee-joint is shown in Figure 6. As the bearing faces of the tongue and joint are carefully made with parallel surfaces, the taper screw, properly set in the process of manufacture, requires no further adjustment; this screw causes the upper leg to exert the proper pressure on the tongue of the lower leg and there is smooth and even resistance without any lost motion. The legs are held firmly in any position in which they may be set.

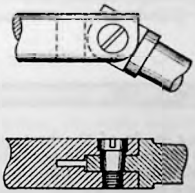


Fig. 6.

Particular care is exercised in the making and fitting of all screws and screw heads, as these adjuncts although apparently unimportant, are really vital parts of the instrument.

MINUSA
TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

MINUSA DIVIDERS.

The dividers are made with the same care in regard to workmanship, and are of the same high-grade nickel silver as the compasses. The tapering legs add to the perfect balance and neat appearance of these instruments.



Fig. 7.



Fig. 8.

The plain divider, as shown in Figure 7, requires no further explanation. In the hairspring divider there is an improvement to enable the divider to be readily set to an exact spacing, a slow motion arrangement being provided on one leg of the divider (Figure 8). The needle points are made of the best grade steel, carefully hardened and tempered, and rigidly set into the legs without the use of clamp screws; there is, therefore, nothing to obstruct the view in setting the divider.

MINUSA RULING PENS.

The drawing pen is that part of a draftsman's outfit which is in most constant use and the one, therefore, in which defects in quality or construction most readily become apparent.

A specially equipped division of our factory, (a view of which is shown on page 86), takes care of the grinding, polishing and sharpening of these instruments.



Minusa ruling pens are made of the best quality high grade tool steel, manufactured especially for the purpose, in accordance with our own specifications. Not only has our laboratory gone into the selection of the proper steel very exhaustively, but we have installed a most elaborate heat treating equipment, which, by means of temperature control apparatus, enables us to subject our steel instruments to the proper heat treatment. These advantages make for uniformity which ensures the proper hardness and temper of each part.

Minusa pens are made in the 4½" and 5½" lengths, with one spring blade, and are rounded in shape to conform with the general appearance of the other Minusa instruments.

MINUSA
TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

MINUSA STEEL SPRING BOWS

(with nickel silver legs)

In these instruments we have developed several new features which would warrant description in detail.

It is important in any type of bow instrument to have a practically uniform spring action throughout the entire range of the instrument. In the all-steel type instrument, exemplified by our PARAGON grade, the upper half of each leg constitutes a long spring in itself and smooth action is readily obtained; with the steel spring head, however, in which a small round spring of uniform cross section (Figure 9) takes all of the action upon itself, the force exercised by the spring upon the legs is naturally much greater when the spring is under a strain than when it is relaxed. Furthermore, with a spring of this kind, if an even pressure be applied at each end by pressing the legs together, the strain is not taken up throughout the spring, but is concentrated at the center where the handle is attached.



Fig. 9



Fig. 10.

In order to attain a uniform tension with the legs in any position, a taper in the thickness of the spring from the center towards both ends (as shown in Figure 10) is provided. This arrangement exemplifies the well known principle of the cantilever spring, the cross section of which diminishes on a parabolic curve towards the ends where the pressure is applied; as the spring action is equally strong at all points, every part of the spring head takes up the strain, and a uniform pressure is exerted on the legs throughout their entire range, thus ensuring a smooth, even motion of the adjusting screw.

We have spared no expense in the development and manufacture of this special shaped spring, and feel confident that it is a feature which will be appreciated by the draftsman.

KEUFFEL & ESSER CO. NEW YORK

MINUSA

TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

The well-known principle of the ball and socket is used where the adjusting screw nut is in contact with the leg of the bow instrument, the leg being counter-sunk to act as a socket for the ball face of the adjusting screw nut.

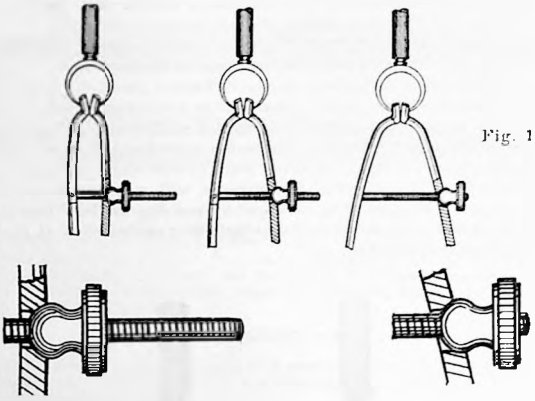


Fig. 11.

The construction of the ball and socket joint can be seen from the three illustrations (Figure 11). We call attention to the fact that the threads of the adjusting screw cannot rub on the sides of the clearance hole. This is an important detail as it overcomes the possibility of a thread of the screw becoming damaged.

In the bow pen and pencil the needle clamp and nut are attached in such a manner that they cannot accidentally become separated from the leg; this construction obviates a frequent objection to the use of the usual type of bow instrument.

In the bow divider the needle points are fastened directly into the legs, (movable points are unnecessary on the divider), and thus there is nothing to obstruct the view in making precise settings.

Many draftsmen prefer bow instruments provided with a center thumb-nut instead of the usual single screw, as this arrangment allows double motion, and necessitates, therefore, only half the number of turns generally required to set the legs of the bow to the desired spread. Furthermore, the stiffness of the bow is not dependent on the strength of the spring as both legs are held rigidly by the screw.

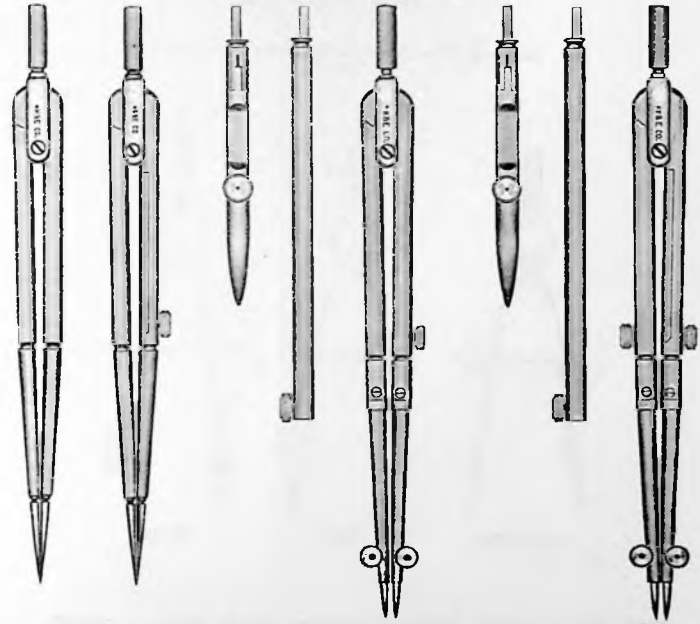
KEUFFEL & ESSER CO. NEW YORK

MINUSA
TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

Each instrument stamped "Minusa" and K & E Co.



No. N 746. N 748. N 750. N 751.

N746. Plain Divider, 5½ in. . . . . each $

N748. Hairspring Divider, 5½ in. . . . . "

N750. Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point, and Lengthening Bar. . . . . "

N751. Compasses, 6½ in., with fixed Needle Point, with Hairspring, Pen, Pencil Point, and Lengthening Bar, ... "

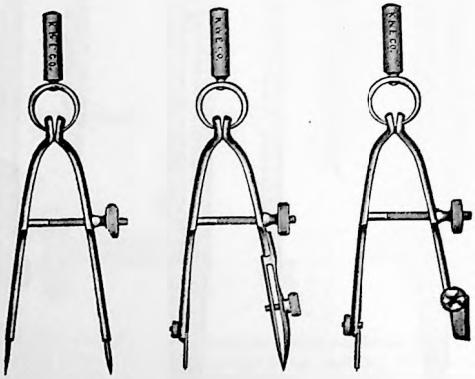
N759. Lead Box, containing 3 Leads. . . . . "

MINUSA
TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

Each Instrument stamped "Minusa" and K & E CO.



No. N 760. N 761. N 762.

N760. Steelspring Bow Divider, nickel silver Handle, 3½ in. . . . each $

N761. Steelspring Bow Pen, Spring Blade, with adjustable Needle Point, nickel silver Handle, 3½ in. . . . . "

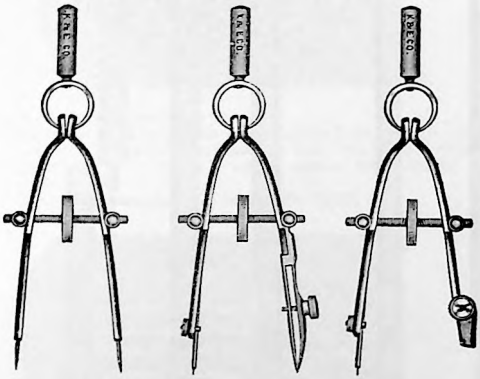
N762. Steelspring Bow Pencil, with adjustable Needle Point, nickel silver Handle, 3½ in. . . . . "

MINUSA
TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

Each Instrument stamped "Minusa" and K & E Co.



No. N 765. N 766. N 767.

N765. Steelspring Bow Divider, with central thumbnut, nickel silver Handle, 3½ in. . . . . each $

N766. Steelspring Bow Pen, with central thumbnut, Spring Blade, with adjustable Needle Point, nickel silver Handle, 3½ in. "

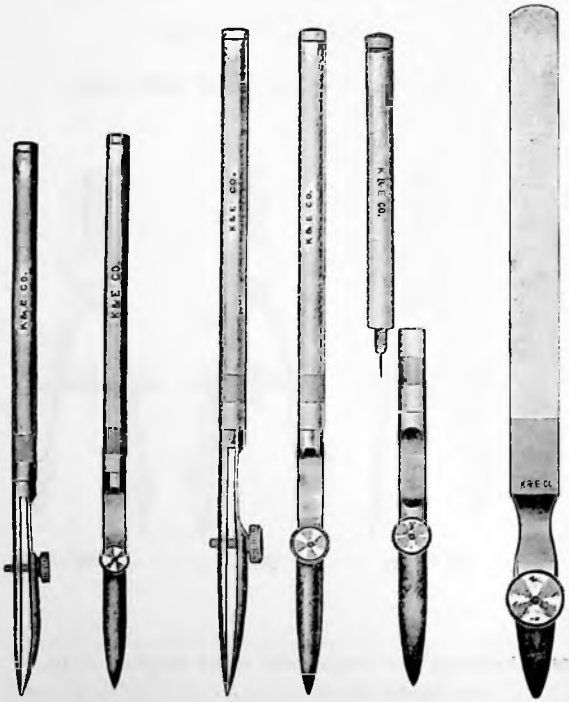
N767. Steelspring Bow Pencil, with central thumbnut, with adjustable Needle Point, nickel silver Handle, 3½ in. . "

MINUSA
TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

Each Instrument stamped "Minusa" and K & E Co.



No. N 772. N 774. N 775. N 777.

N772. Drawing Pen, upper blade with spring, 4½ in. . . . . each $

N774. Drawing Pen, upper blade with spring, 5½ in. . . . . "

N775. Drawing Pen, upper blade with spring, 5½ in., detachable Handle with pricker point. . . . . "

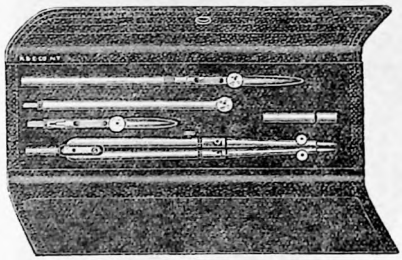
N777. Detail Pen, upper blade with spring, 6 in. . . . . "

MINUSA
TRADE MARK

DRAWING INSTRUMENTS.

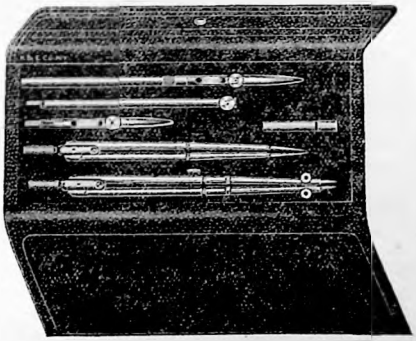
Made in the U. S. A.

Each Instrument stamped "Minusa" and K & E Co.



No. N 786

N780. Pocket Case, containing:-
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. N750,
1 Drawing Pen, 5½ in., upper blade with spring, No. N774.
1 Lead Box containing 3 leads, No. N759. . . . . each $

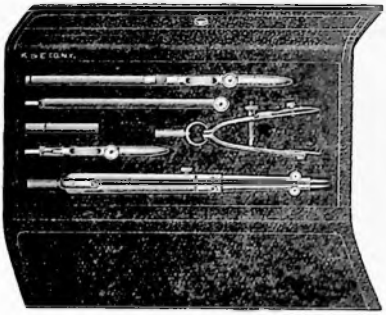


No. N 782.

N782. Pocket Case containing:-
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point, and Lengthening Bar, No. N750,
1 Plain Divider, 5½ in., No. N746,
1 Drawing Pen, 5½ in., upper blade with spring, No. N774.
1 Lead Box containing 3 leads, No. N759. . . . . each $

MINUSA
TRADE MARK

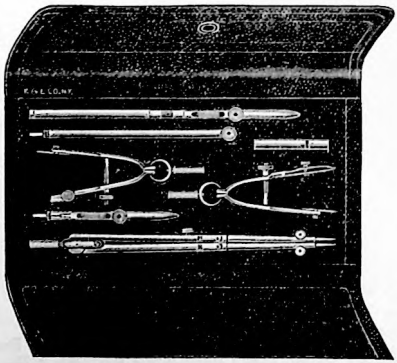
DRAWING INSTRUMENTS.



No. N 783.

N783. Pocket Case containing:-

1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. N750.
1 Drawing Pen, 5½ in., upper blade with spring, No. N774.
1 Steelspring Bow Pen, 3¼ in., No. N761.
1 Lead Box, containing 3 leads, No. N759, ... each $

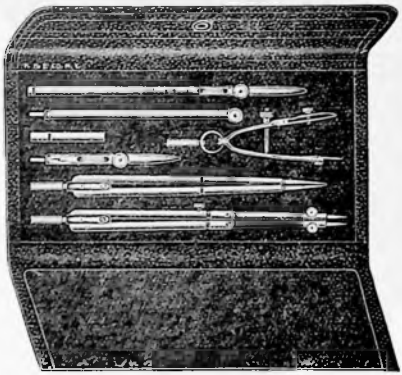


No. N 783½.

N783½. Pocket Case, containing same assortment as No. N 783 but with the addition of 1 Steelspring Bow Pencil, No. N762. each $

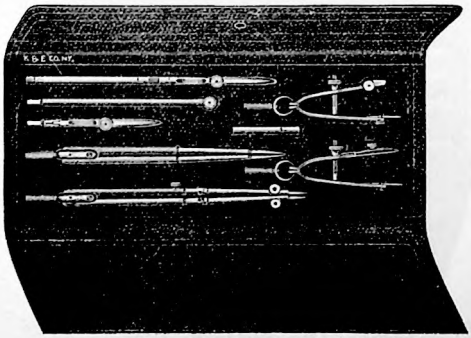
MINUSA
TRADE MARK

DRAWING INSTRUMENTS.



No. N 784.

N784. Pocket Case containing:—
1 Compasses 6½ in., with fixed Needle Point, Pen, Pencil Point, and Lengthening Bar, No. N750,
1 Plain Divider, 5½ in., No. N746,
1 Steelspring Bow Pen, 3½ in., No N761,
1 Drawing Pen, 5½ in., upper blade with spring, No. N774,
1 Lead Box, containing 3 leads, No. N759, ... each $

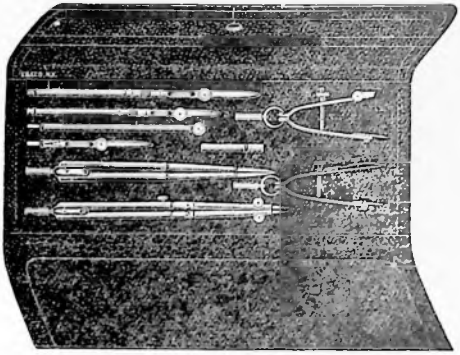


No. N 784½

N784½. Pocket Case containing same assortment as No. N784 but with the addition of 1 Steelspring Bow Pencil No. N762, each $

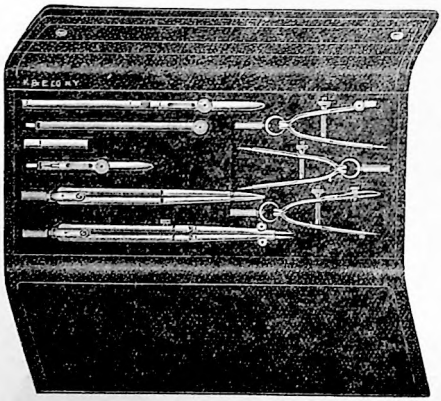
MINUSA.

TRADE MARK



No. N 785.

N785. Pocket Case containing:-
1 Compasses, 6½ in., No. N750,
1 Plain Divider, 5½ in., No. N746,
1 Steelspring Bow Pen, 3½ in., No. N761,
1 Steelspring Bow Pencil, 3½ in. No. N762,
2 Drawing Pens, 4½ in. and 5½ in., Nos. N 772 and N 774,
1 Lead Box containing 3 leads, No. N759 . . . . . each $



No. N 785½.

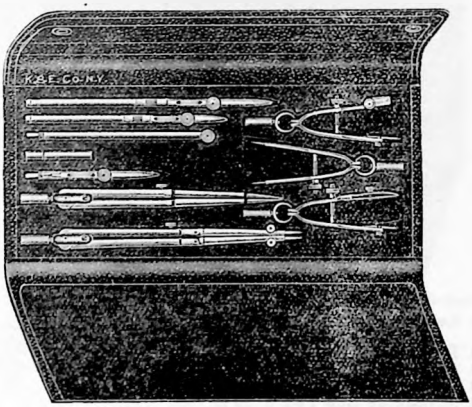
N785½. Pocket Case containing same assortment as No. N 785 but with the addition of Bow Divider No. N760 and without Pen No. N 772 . . . . . each $

MINUSA
TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

Each Instrument stamped "Minusa" and K & E Co.



No. N 786

N786. Pocket Case containing:-

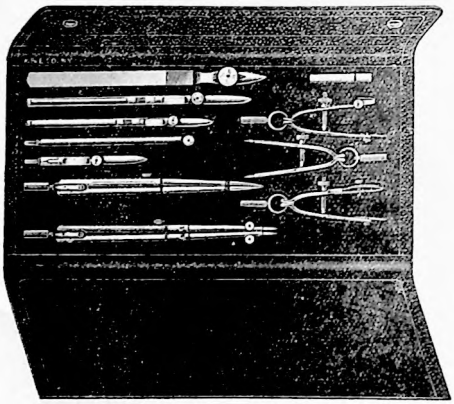
1 Compasses 6¼ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. N750,
1 Hairspring Divider, 5½ in. No. N748,
1 Steelspring Bow Divider, 3½ in., No. N760,
1 Steelspring Bow Pen, 3½ in., No. N761,
1 Steelspring Bow Pencil, 3½ in., No. N762,
1 Drawing Pen, 4½ in., No. N772.
1 Drawing Pen, 5½ in., No. N774,
1 Lead Box containing 3 leads, No. N759 . . . . . **each $**

MINUSA
TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

Each Instrument stamped "Minusa" and K & E Co.



No. N786½.

N786½. Pocket Case containing:-
1 Compasses 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. N750,
1 Plain Divider 5½ in., No. N746,
1 Steelspring Bow Divider, 3½ in., No. N760,
1 Steelspring Bow Pen, 3½ in., No. N761,
1 Steelspring Bow Pencil, 3½ in., No. N762,
1 Drawing Pen 4½ in., No. N772,
1 Drawing Pen 5½ in., No. N774,
1 Detail Pen, 6½ in., No. N777,
1 Lead Box containing 3 leads, No. N759 . . . . . each $

N786½. Pocket Case containing:-
Same assortment as No. N786½, but with Hairspring Divider No. N748 . . . . . each $

N787. Pocket Case containing:-
1 Compasses 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. N750,
1 Hairspring Divider, 5½ in., No. N748,
1 Steelspring Bow Divider, 3½ in., No. N760,
1 Steelspring Bow Pen, 3½ in., No. N761,
1 Steelspring Bow Pencil, 3½ in., No. N762,
1 Drawing Pen, 4½ in., No. N772,
1 Drawing Pen, 5½ in., No. N774,
1 Payzant Lettering Pen, No. 6,
1 Lead Box containing 3 leads, No. N759 . . . . . each $

MINUSA *Special*

DRAWING INSTRUMENTS

We have added to our line of Minusa Drawing Instruments new types of bow instruments and ruling pens which are illustrated in this pamphlet, and designated MINUSA *Special*

The MINUSA *Special* Bows have been constructed so as to conform in shape and design with the Minusa Compasses and dividers and possess the same superior qualities of durability and accuracy.

MINUSA *Special* ruling pens are hexagonal in form and more highly finished and handsomer in appearance than the regular Minusa pen made of round stock.

The MINUSA *Special* sets of drawing instruments are made up of the regular Minusa compasses and dividers with MINUSA *Special* bows and ruling pens, and fitted into a very handsome genuine morocco leather case with fine silk velvet lining.

KEUFFEL & ESSER CO.

NEW YORK, 127 Fulton Street, General Office and Factories, **HOBOKEN, N. J.**

CHICAGO 518-20 S. Dearborn St. **ST. LOUIS** 8:7 Locust St. **SAN FRANCISCO** 30-34 Second St. **MONTREAL** 5 Notre Dame St. W.

Drawing Materials, Mathematical and Surveying Instruments, Measuring Tapes

MINUSA *Special*

TRADE MARK.

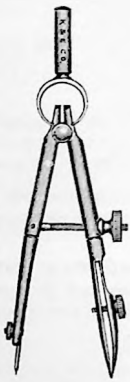
DRAWING INSTRUMENTS.

Made in the U. S. A.

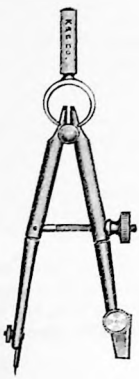
Each Instrument stamped "Minusa" and K & E CO.



No. N 760¼.



N 761¼.



N 762¼.

N 760¼. Steelspring Bow Divider, nickel silver handle, 3½ in. . . . . each $

N 761¼. Steelspring Bow Pen, Spring Blade, with adjustable Needle Point, nickel silver Handle, 3½ in. . . . . "

N 762¼. Steelspring Bow Pencil, with adjustable Needle Point, nickel silver Handle, 3½ in. . . . . "

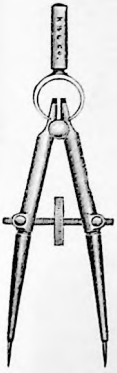
MINUSA *Special*

TRADE MARK

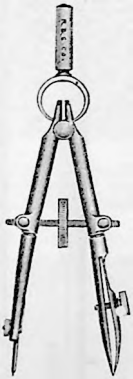
DRAWING INSTRUMENTS.

Made in the U. S. A.

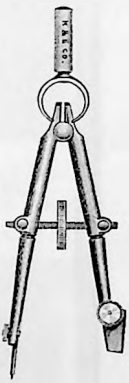
Each Instrument stamped "Minusa" and K & E CO.



No. N 765½.



N 766½.



N 767½.

N 765½. Steelspring Bow Divider, with central thumbnut, nickel silver Handle, 3½ in.....each $

N 766½. Steelspring Bow Pen, with central thumbnut, with adjustable Needle Point, nickel silver Handle, 3½ in..... "

N 767½. Steelspring Bow Pencil, with central thumbnut, with adjustable Needle Point, nickel silver Handle, 3½ in.... "

KEUFFEL & ESSER CO. NEW YORK

MINUSA TRADE MARK *Special*

DRAWING INSTRUMENTS.

Made in the U. S. A.

Each Instrument stamped "Minusa" and K & E CO.



No. N 772½. N 774½. N 775½.

Made from highest grade octagonal steel, finest finish.

N 772½. Drawing Pen, upper blade with spring, 4½ in.....each $

N 774½. Drawing Pen, upper blade with spring, 5½ in..... "

N 775½. Drawing Pen, upper blade with spring, 5½ in., detachable Handle with pricker point..... "

KEUFFEL & ESSER CO. NEW YORK

MINUSA TRADE MARK *Special*

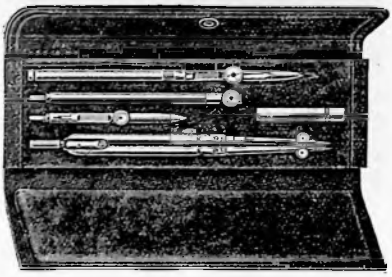
DRAWING INSTRUMENTS.

Made in the U. S. A.

Each Instrument stamped "Minusa" and K & E CO.

Sets are in genuine Morocco Leather Cases with Silk Velvet Lining.

For description of construction of Minusa Special Instruments see pages 92a to 92f.



No. N 790.

N 790. Pocket Case containing:—
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. N 750,
1 Drawing Pen, 5½ in., upper blade with spring, No. N 774½.
1 Lead Box containing 3 leads, No. N 759½.....each $



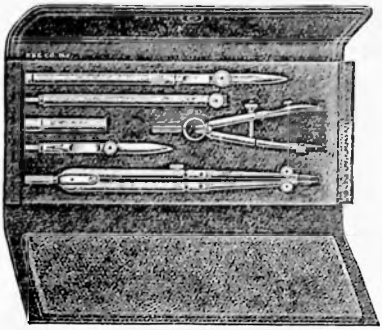
No. N 792.

N 792. Pocket Case containing:—
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point, and Lengthening Bar, No. N 750,
1 Plain Divider, 5½ in., No. N 746,
1 Drawing Pen, 5½ in., upper blade with spring, No. N 774½.
1 Lead Box containing 3 leads, No. N 759½.....each $

MINUSA TRADE MARK *Special*

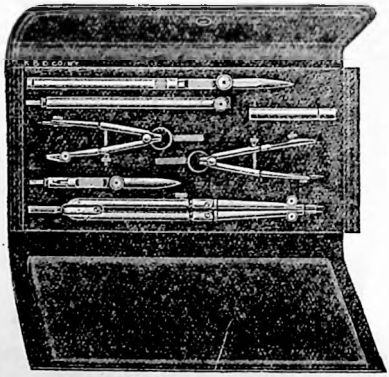
DRAWING INSTRUMENTS.

In genuine Morocco Leather Cases with Silk Velvet Lining.



No. N 793.

N 793. Pocket Case containing:—
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. N 750
1 Drawing Pen, 5½ in., upper blade with spring, No. N 774½,
1 Steelspring Bow Pen, 3½ in., No. N 761½,
1 Lead Box, containing 3 leads, No. N 759½ ..... each $



No. N 793½.

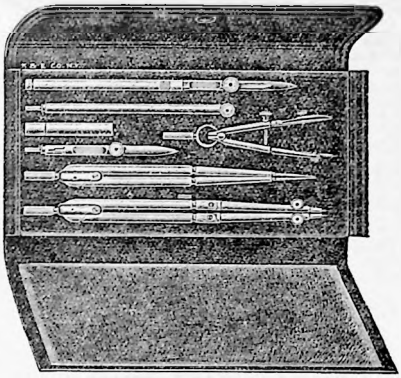
N 793½. Pocket Case, containing same assortment as No. N 793, but with the addition of 1 Steelspring Bow Pencil, No. N 762½ ..... each $

MINUSA *Special*

TRADE MARK

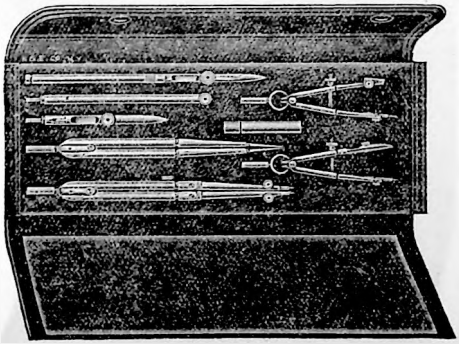
DRAWING INSTRUMENTS

In genuine Morocco Leather Cases with Silk Velvet Lining.



No. N 794.

N 794. Pocket Case containing:—
1 Compasses 6½ in., with fixed Needle Point, Pen, Pencil Point, and Lengthening Bar, No. N 750,
1 Plain Divider, 5½ in., No. N 746,
1 Steelspring Bow Pen, 3½ in., No. N 761½,
1 Drawing Pen, 5½ in., upper blade with spring, No. N 774½,
1 Lead Box, containing 3 leads, No. N 759½ . . . . . each $



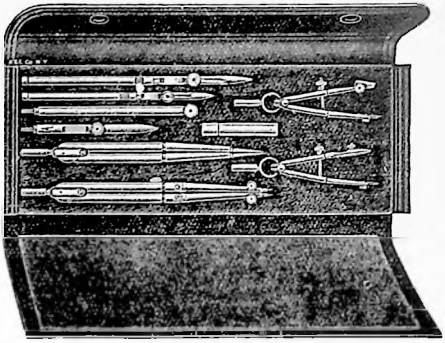
No. N 794½.

N 794½. Pocket Case containing same assortment as No. N 794, but with the addition of 1 Steelspring Bow Pencil No. N 762½, each $

MINUSA *Special*

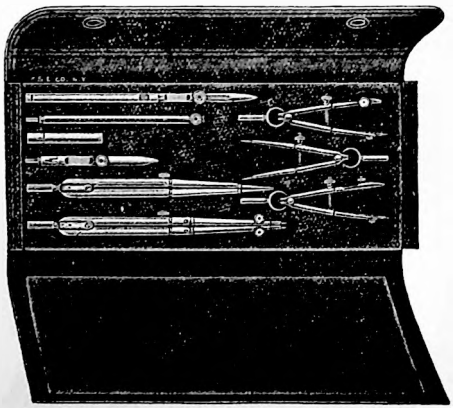
TRADE MARK

In genuine Morocco Leather Cases with Silk Velvet Lining.



No. N 795.

N 795. Pocket Case containing:—
1 Compasses, $6\frac{1}{2}$ in., No. N 750,
1 Plain Divider, $5\frac{1}{2}$ in., No. N 746,
1 Steelspring Bow Pen, $3\frac{1}{2}$ in., No. N $761\frac{1}{2}$,
1 Steelspring Bow Pencil, $3\frac{1}{2}$ in., No. N $762\frac{1}{2}$,
2 Drawing Pens, $4\frac{1}{2}$ in. and $5\frac{1}{2}$ in., Nos. N $772\frac{1}{2}$ and N $774\frac{1}{2}$,
1 Lead Box containing 3 leads, No. N $759\frac{1}{2}$ ..... each $



No. N 795½.

N 795½. Pocket Case containing same assortment as No. N 795, but with the addition of Bow Divider No. N $760\frac{1}{2}$, and without Pen No. N $772\frac{1}{2}$ ..... each $

KEUFFEL & ESSER CO. NEW YORK

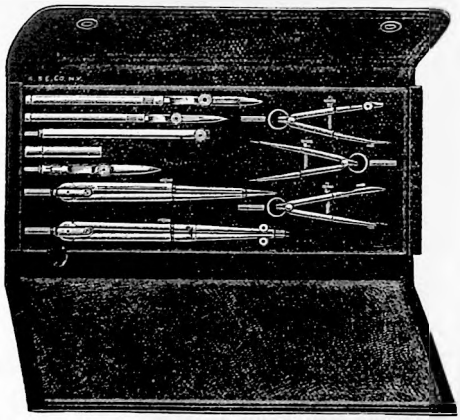
MINUSA *Special*

TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

Each Instrument stamped "Minusa" and K & E CO.
In genuine Morocco Leather Cases with Silk Velvet Lining.



No. N 796.

N 796. Pocket Case containing:—
1 Compasses 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. N 750,
1 Hairspring Divider, 5½ in. No. N 748,
1 Steelspring Bow Divider, 3½ in., No. N 760½,
1 Steelspring Bow Pen, 3½ in., No. N 761½,
1 Steelspring Bow Lencil, 3½ in., No. N 762½,
1 Drawing Pen, 4½ in., No. N 772½,
1 Drawing Pen, 5½ in., No. N 774½,
1 Lead Box containing 3 leads, No. N 759½.....each $

MINUSA *Special*

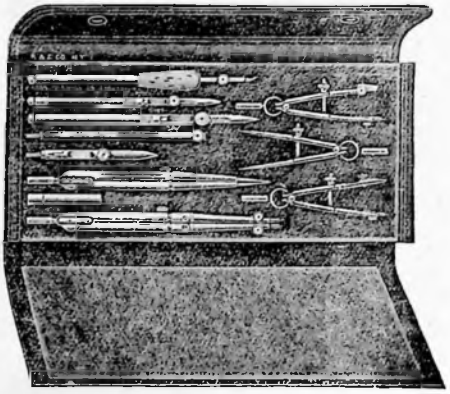
TRADE MARK

DRAWING INSTRUMENTS.

Made in the U. S. A.

Each Instrument stamped "Minusa" and K & E CO.

In genuine Morocco Leather Cases with Silk Velvet Lining.



No. N 797.

N 796½. Pocket Case containing: —
1 Compasses 6¼ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. N 750,
1 Hairspring Divider 5¾ in., No. N 748,
1 Steelspring Bow Divider, 3½ in., No. N 760½,
1 Steelspring Bow Pen, 3½ in., No. N 761½,
1 Steelspring Bow Pencil, 3½ in., No. N 762½,
1 Drawing Pen 4½ in., No. N 772½,
1 Drawing Pen, 5½ in., No. N 774½,
1 Detail Pen, 6¼ in., No. N 777,
1 Lead Box containing 3 leads, No. N 759½ . . . . . each $

N 797. Pocket Case Containing:—
1 Compasses 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. N 750,
1 Hairspring Divider, 5¾ in., No. N 748,
1 Steelspring Bow Divider, 3½ in., No. N 760½,
1 Steelspring Bow Pen, 3½ in., No. N 761½,
1 Steelspring Bow Pencil, 3½ in., No. N 762½,
1 Drawing Pen, 4½ in., No. N 772½,
1 Drawing Pen, 5½ in., No. N 774½,
1 Payzant Lettering Pen, No. 8,
1 Lead Box containing 3 leads, No. N 759½ . . . . . each $

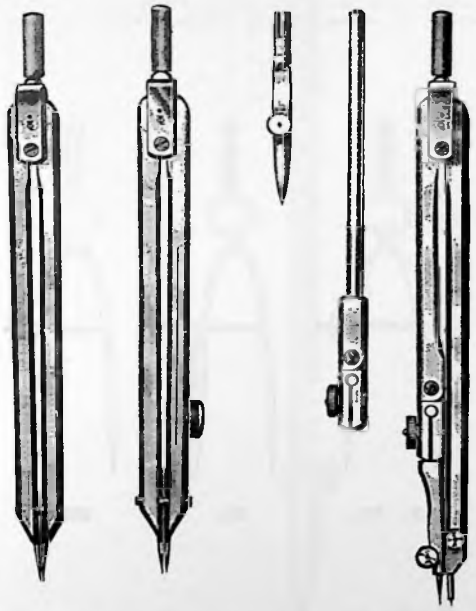
PILOT

DRAWING INSTRUMENTS.

Made in U. S. A.

Each instrument stamped with trade mark Ⓚ

In the Pilot Compass we have developed a serviceable instrument at a low price. A friction spring under the fork retains the handle in any desired position.



No. 946. 948. 950.

946. Plain Divider, 5¾ in. . . . . each $

948. Hairspring Divider, 5¾ in. . . . . "

950. Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar . . . . . "

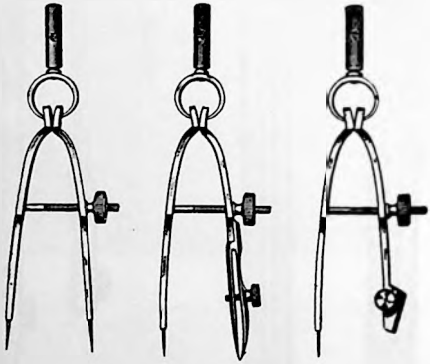
PILOT

DRAWING INSTRUMENTS

Made in U. S. A.

Each instrument stamped with trade mark Ⓚ

Pilot Bows have legs made of nickel silver and a steel spring bow head. This head is so designed as to give uniform tension throughout the entire range.



No. 960. 961. 962.

960. Steelspring Bow Divider, nickel silver Handle, 3½ in. . . **each** $

961. Steelspring Bow Pen, Spring Blade, with Needle Point, nickel silver Handle, 3½ in. . . . . "

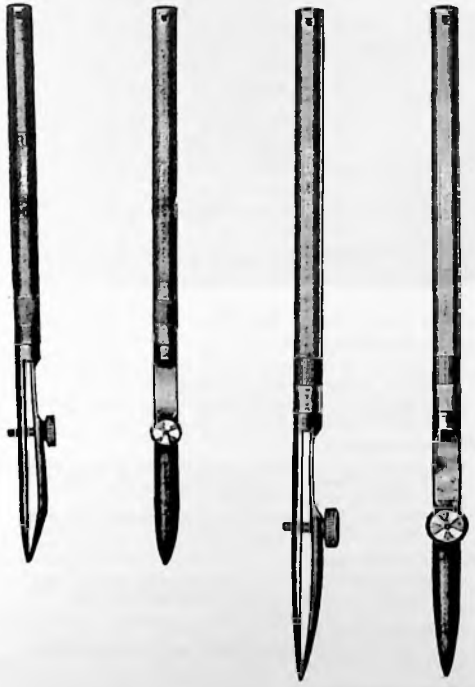
962. Steelspring Bow Pencil, with Needle Point, nickel silver Handle, 3½ in. . . . . "

PILOT
DRAWING INSTRUMENTS.

Made in U. S. A.

Each instrument stamped with trade mark Ⓚ

Pilot Pens, round in shape, are well made and carefully hardened and tempered.



No. 972. 974.

972. Drawing Pen, upper blade with spring, 4½ in. . . . . each $

974. Drawing Pen, upper blade with spring, 5½ in. . . . . "

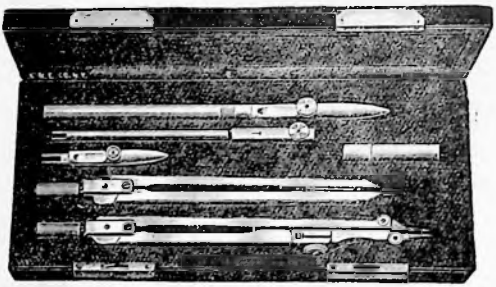
959. Lead Box, containing 3 leads . . . . . "

PILOT

DRAWING INSTRUMENTS.

Made in U. S. A.

Each instrument stamped with trade mark Ⓟ



No. 982.

980. Pocket Case containing:-
- 1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 950,
- 1 Drawing Pen, 5½ in., upper blade with spring, No. 974,
- 1 Lead Box containing 3 leads, No. 959, ... each †

982. Pocket Case containing:-
- 1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 950,
- 1 Plain Divider, 5¾ in., No. 946,
- 1 Drawing Pen, 6½ in., upper blade with spring, No. 974,
- 1 Lead Box containing 3 leads, No. 959, ... "

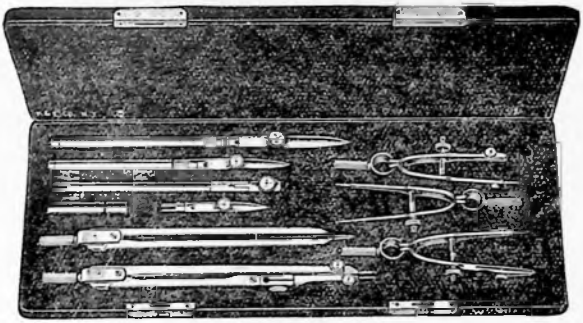
984. Pocket Case containing:-
- 1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 950,
- 1 Plain Divider, 5¾ in., No. 946,
- 1 Steelspring Bow Pen, 3½ in., No. 961,
- 1 Drawing Pen, 5½ in., upper blade with spring, No. 974,
- 1 Lead Box containing 3 leads, No. 959, ... each ‡

984½. Pocket Case containing:-
- 1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point, and Lengthening Bar, No. 950,
- 1 Plain Divider, 5¾ in., No. 946,
- 1 Steelspring Bow Pen, 3½ in., No. 961,
- 1 Steelspring Bow Pencil, 3½ in., No. 962,
- 1 Drawing Pen, 5½ in., upper blade with spring, No. 974,
- 1 Lead Box containing 3 leads, No. 959, ... "

PILOT DRAWING INSTRUMENTS.

Made in U. S. A.

Each instrument stamped with trade mark



No. 986.

985. Pocket Case containing:-
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 950,
1 Plain Divider, 5¾ in., No. 946,
1 Steelspring Bow Pen, 3½ in., No. 961,
1 Steelspring Bow Pencil, 3½ in., No. 962,
1 Drawing Pen, 4½ in., upper blade with spring, No. 972,
1 Drawing Pen, 5½ in., upper blade with spring, No. 974,
1 Lead Box containing 3 leads, No. 959, ... each $

985½. Pocket Case containing:-
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 950,
1 Plain Divider, 5¾ in., No. 946,
1 Steelspring Bow Divider, 3½ in., No. 960,
1 Steelspring Bow Pen, 3½ in., No. 961,
1 Steelspring Bow Pencil, 3½ in., No. 962,
1 Drawing Pen, 5½ in., upper blade with spring, No. 974,
1 Lead Box containing 3 leads, No. 959, ... "

986. Pocket Case (as illustrated above) containing:-
1 Compasses, 6½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 950,
1 Plain Divider, 5¾ in., No. 946,
1 Steelspring Bow Divider, 3½ in., No. 960,
1 Steelspring Bow Pen, 3½ in., No. 961,
1 Steelspring Bow Pencil, 3½ in., No. 962,
1 Drawing Pen, 4½ in., upper blade with spring, No. 972,
1 Drawing Pen, 5½ in., upper blade with spring, No. 974,
1 Lead Box containing 3 leads, No. 959, ... "

986H. like No. 986 but with Hairspring Divider, No. 948 instead of Plain Divider No. 946, ... "

SEPARATE PARTS

FOR

PARAGON BRAND INSTRUMENTS.

To accommodate our customers we keep in stock separate parts for our Mathematical Instruments, as listed below. While we can replace parts for compasses, we can replace neither the compasses (to be fitted to parts), nor the three-cornered steel legs of compasses. To repair points which are not detachable from the compasses (fixed points) is generally not advisable.

As all inserts to compasses are carefully fitted by hand, they are not interchangeable, but must be fitted to the instrument. The charge for such fitting is included in the following prices.

PARTS FOR PARAGON INSTRUMENTS.

Pen Points, Pencil Points, Needle Points,	for Compasses . . .	each $
do. do.	do. " Beam Compasses	"
Lengthening Bars for Compasses		"
Ebony Handles for Drawing Pens		"
Ivory do. "	do.	"
Aluminum do. "	do.	"
Ivory do. "	Bow Instruments	"
Nickel silver do. "	do.	"
Nut and Thread "	do. Nos. 460½ to 482½	"
Thumbscrew with right and left Thread for Nos. 485 to 487 . .		"
Screws and Nuts		"
Shouldered Needles		"

PARTS FOR ANCHOR AND PILOT INSTRUMENTS.

Pen Points, Pencil Points, Needle Points,	for Compasses . . .	each $
Lengthening Bars for Compasses		"
Ebony Handles for Drawing Pens		"
Aluminum do. "	do.	"
Nickel Silver Handles for Bows Nos. A 660, A 661, A 662, . . .		"
	and 960, 961, 962	"
Screws and Nuts		"

We have the best facilities for Repairing and Cleaning Drawing Instruments and Sharpening Ruling Pens.

CASES FOR DRAWING INSTRUMENTS.

We make and furnish well-made velvet lined cases for drawing instruments. Below are listed some of the usual sizes.

When ordering a case separate from the instruments, it is necessary to send on the instruments to insure their proper fitting in the tray.

The price of the case includes the fitting of the instruments.

WOODEN CASES WITH LOCK AND TRAY.

These Cases are made of thoroughly seasoned wood, have a tray to hold the instruments, and under the tray, room for colors, brushes, etc.

Partitions under the tray for tools, colors, etc., can be added at slight additional cost.

The dimensions refer to the size of the tray in the box.

Size of Tray.	Mahogany, Brass Hinges and Shield, Tray lined with Velvet. No. 992.	Mahogany polished, nickel Silver Shield, Hinges and Lock plated. Tray lined with Silk Velvet. No. 994.
B. 5 × 9 in.	. . . . . each $	. . . . . each $
C. 5 × 12½ "	. . . . . "	. . . . . "
D. 6 × 10 "	. . . . . "	. . . . . "
F. 7 × 13 "	. . . . . "	. . . . . "
G. 10 × 14 "	. . . . . "	. . . . . "

Cases of mahogany, oak or other wood, with drawers, nickel silver or plated corners, bands, name plate, escutcheon etc., made to order.

POCKET CASES

WITH FOLDING FLAPS.

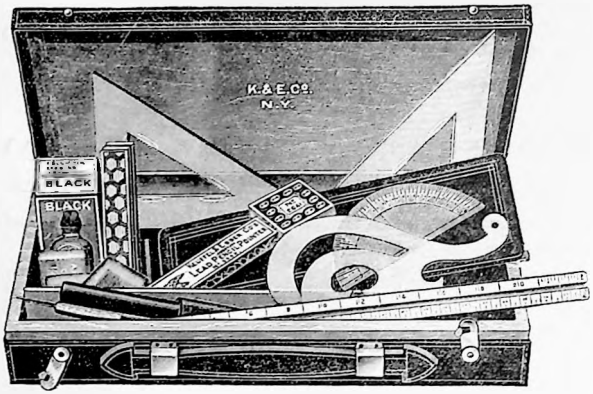
These Cases are covered with morocco, velvet lined with four flaps, with button lock as illustrated on pages 90, etc.

Size of Case about	Lined with Velvet. No. 996.	Lined with Silk Velvet. No. 998.
A. 3 × 6 in.	. . . . . each $	. . . . . each $
B. 3½ × 7½ "	. . . . . "	. . . . . "
C. 3½ × 8½ "	. . . . . "	. . . . . "
D. 3½ × 9½ "	. . . . . "	. . . . . "
E. 4 × 9½ "	. . . . . "	. . . . . "
F. 4½ × 9¾ "	. . . . . "	. . . . . "
G. 4¾ × 10 "	. . . . . "	. . . . . "
H. 5½ × 10 "	. . . . . "	. . . . . "

For other cases, see page 100.

CARRYING CASE FOR DRAWING TOOLS.

(Dress Suit Case Style.)



No. 990.

990. Sewed Leather Carrying Case for Drawing Tools . . . . . each $

Fine Sewed Sole Leather Case, natural color, $13\frac{1}{2} \times 7\frac{1}{2} \times 2\frac{1}{2}$ in., with grip handle and nickelplated safety hooks, lined with wood and partitioned for set of instruments, triangles, curves, scales, pencils, thumbtacks, rubbers, liquid ink, pencil pointer, etc. A neat, convenient, and durable case for students and others who carry their drawing tools about.

EXTRA-FINE POCKET CASES, FANCY LEATHER, WITH FOLDING FLAPS.

We furnish to order Pocket Cases with Folding Flaps (see illustration of No. 624, page 76 or of No. 624A, page 78,) of finest workmanship, lined with silk velvet and covered with fancy leather, such as **Walrus, Genuine morocco, Pigskin, Alligator, Russia leather, Seal, Lizard** etc. Such cases are very appropriate for gifts. Prices on application.

For other empty cases for instruments, see page 99.

PROPORTIONAL DIVIDERS.



No. 1092.



1093.



1094.

1092. Brass Proportional Dividers, 6¼ in., divided for Lines; in Case . . . . . each $

1093. Nickel silver Proportional Dividers, 6¼ in., divided for Lines; in Case . . . . . "

1094. Nickel silver Proportional Dividers, 7 in., divided for Lines, with Rack Movement, Points bent rectangular; in Case . . . . . "

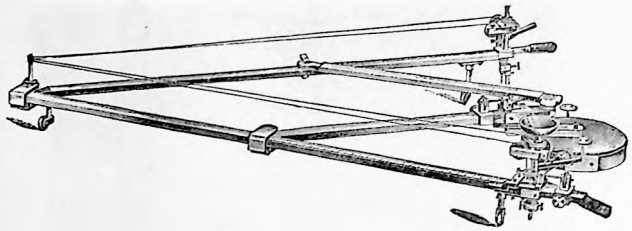
The rectangular bent points permit of re-pointing without affecting accuracy.

For other Proportional Dividers, see pages 57, 58. and 59.

PANTOGRAPHS

with Wheel Supports.

For Reducing from 6 : 1 to 1 : 1 or Enlarging from 1 : 1 to 1 : 6 in all ratios.



No. 1127.

1127. Pantograph of hollow, square brass bars, 28 in., connected by pivot joints. The left-hand bar is graduated and has a vernier and micrometer adjustment. Convenient contrivance for operating the pencil from the tracing point. Iron weight with two adjustable needle points to fix its position on the drawing board. With Pencil Point, two Steel Points, one box of 5-inch Leads and Directions; in wooden Case with lock and key . . . . . each $

Pantograph No. 1127 is of high quality and workmanship. It moves on casters and is not suspended from a standard. Although this causes a little more friction, it makes the instrument better adapted for use in a limited space. It can also be stored in its case more readily than the suspended pantographs, as it does not require setting up like the latter. This pantograph is adapted especially for reducing, but can be used for enlarging.

SUSPENDED PANTOGRAPHS.

Suspended Pantographs, (Nos. 1122 to 1131) are very delicate instruments. There is no friction of the supports of the bars on the drawing, as the entire mechanism is suspended.

Of the **Suspended Pantographs only Nos. 1122 to 1124 C** will reproduce in all ratios from the size of the original to 1 : 20 or 20 : 1, as only these pantographs have the arrangement for placing the pole within the parallelogram (interchanging the pole for one of the tracing points). Other suspended pantographs do not have this arrangement, and reproduce only within the limits stated in the description of each.

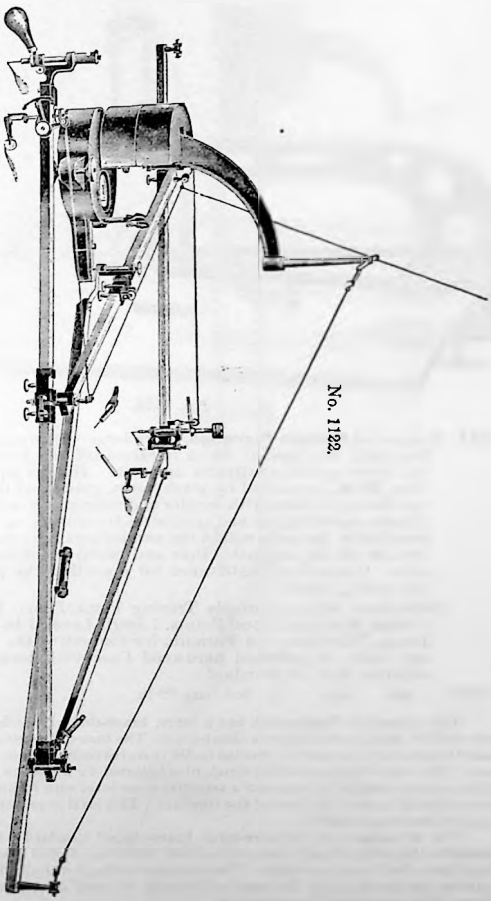
Precision Pantographs Nos. 1122 to 1124 C, on account of their fine mechanical construction, are especially adapted for very accurate reproductions, and are highly recommended to Civil and Mechanical Engineers, Topographers, Hydrographers, Engravers and Lithographers.

Suspended Pantographs Nos. 1129 to 1131 are of simpler construction, although of the same class of workmanship and material as Nos. 1122 to 1124C. These instruments are recommended to Designers, Pattern Makers, etc., for drawings where the highest degree of accuracy is not required.

Suspended Pantographs Nos. 1132 to 1134 have wooden bars which are not graduated throughout; they are, therefore, limited to the ratios for which they are marked, as stated in their description. Within their range they are good, reliable instruments.

PRECISION PANTOGRAPHS.

For Reproducing to even scale, enlarging up to 1 : 20 and reducing up to 20 : 1 in all ratios.



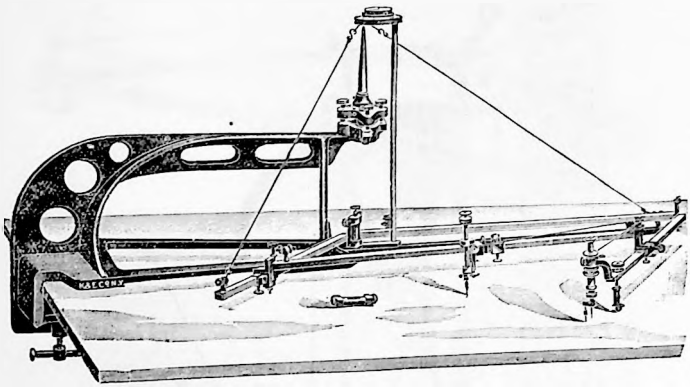
No. 1122.

Suspended Precision Pantograph of hollow, square metal bars, connected by pivot joints; the bars are graduated throughout, and the sliding sockets are provided with verniers and micrometer adjustments. Extra Supporting Bar and appliances for setting up the instrument with the pole within the parallelogram, in which position it will reproduce the size of the original. (See illustration). Pole and pencil point interchangeable. Convenient contrivance for operating the pencil from the tracing point. Solid iron Standard, with 2 Spirit Levels, 2 Leveling Screws, and 1 extra Weight. Instrument, with adjustable Tracing Point, Pencil Point with 3 Brass Weights, 2 Steel Points, 1 Spirit Level, 1 Box of 5-inch Leads, Directions and Formula for computing the setting for any ratio, in polished Hardwood Case, with lock and key.

1122. Length of Bars, 33 inches . . . each $
1123. " " " 38 " . . . . . "

PRECISION PANTOGRAPHS.

For Reproducing to even scale, enlarging up to 1 : 20 and reducing up to 20 : 1 in all ratios.



No. 1124.

1124. Suspended **Precision Pantograph,** extra large adjustable clamping Standard, the base of which is raised off the board, so that the drawing can be slipped under it. Hollow square metal bars, 24 in., connected by pivot joints, graduated throughout, the sliding sockets with vernier and micrometer adjustments. Extra supporting bar and appliances for setting up the instrument with the pole within the parallelogram, to reproduce in the size of the original. Pole and pencil point interchangeable. Convenient contrivance for operating the pencil from the tracing point.

Instrument, with adjustable Tracing Point, Pencil Point with 3 Brass Weights, 2 Steel Points, 1 Spirit Level, 1 box of 5-inch Leads, Directions and Formula for computing the setting for any ratio; in polished hardwood Case with lock and key, separate Box for Standard . . . . . each $

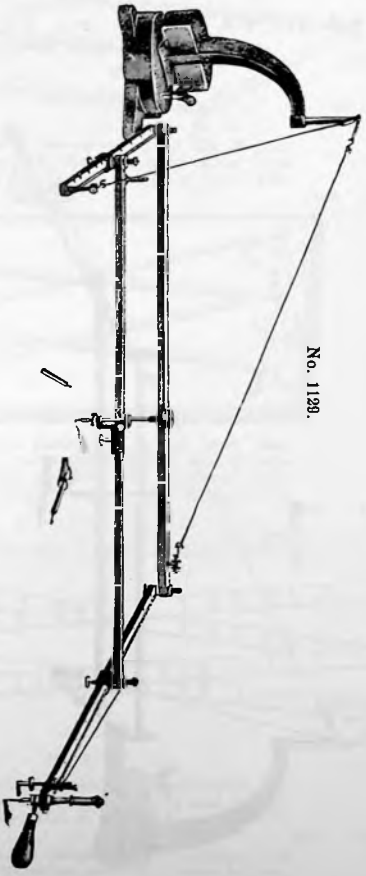
1124 C. do. do. do. but bars 38 in. . . . . "

This suspended Pantograph has a large, brace-shaped standard of great stability and rigidity, held in position by a clamp screw. The base of the standard is raised off the board to admit of slipping the drawing under it, a great convenience when reducing drawings. The vertical support of the standard is adjusted by a 4-screw leveling head and its adjustment controlled by means of a sensitive cross level with fork-shaped support, resting on the ball pole of the base of the standard. This level is removed after the vertical support has been adjusted.

The advantage of the extra-large, brace-shaped standard is that the instrument is clamped to the table or board, thus doing away with weights and avoiding damage to the board from the fastening screw. There are no leveling screws in the base to injure the board or the drawing, and the standard is easily adjusted by means of its four leveling screws (like on surveying instruments).

SUSPENDED PANTOGRAPHS.

For Reducing from 20 : 1 to 5 : 4 or Enlarging from 1 : 20 to 4 : 5 in all ratios.



No. 1129.

Suspended Pantograph of hollow, square metal bars, connected by cone joints; the bars are fully graduated and the edges of the sliding sockets are beveled to facilitate the reading of ratios. Tracing and Pencil Point are interchangeable. Plain solid Iron Standard with extra Weight. Instrument, with adjustable Tracing Point, Pencil Point with 3 Brass Weights, 2 Steel Points, 1 box of 5-inch Leads, Directions and Formula for computing the setting for any ratio; in hardwood Case, with lock and key.

1129.	Length of Bars, 28 inches . . .	each	$
1130.	" " " 33 "	"	
1131.	" " " 38 "	"	

KEUFFEL & ESSER CO., NEW YORK

SUSPENDED PANTOGRAPHS

WITH WOODEN BARS.

For Reducing and Enlarging in the following ratios:

5:4, 4:3, 3:2, 5:3, 2:1, 5:2, 3:1, 4:1, 5:1, 6:1, 8:1, 10:1, 12:1, 20:1, or vice-versa.

No. 1132.

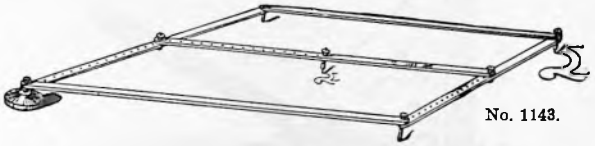
Suspended Pantograph of strong, well-seasoned, wooden Bars, connected by cone joints in brass bearings and provided with holes accurately spaced for the above ratios. Tracing and Pencil Point are interchangeable. Plain solid iron Standard. Instrument, with adjustable Tracing Point, Pencil Point with 3 Brass Weights, 1 Steel Point, 1 box of 5-inch Leads and Directions; in hardwood Case, with lock and key.

1132. Length of Bars, 28 inches . . . . each $

1134. " " " 38 " . . . . "

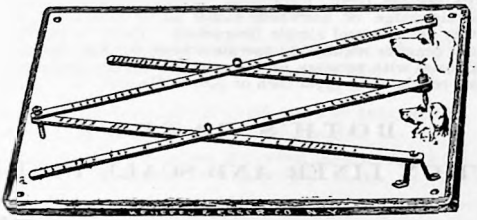
PANTOGRAPHS OF HARDWOOD.

Pantographs 1143-1145 have our improved tracer and lead holders and take the usual Artist Lead, which is interchangeable with the steel tracer. These points are held by a screw sleeve. All metal parts are nickel plated.



No. 1143.

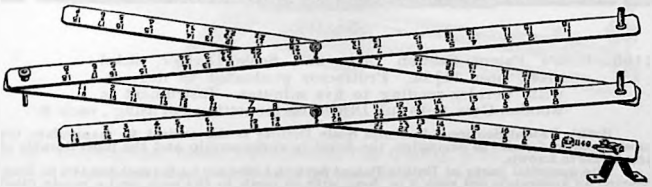
1143. Pantograph of polished Hardwood, bars 22½ in.; for reducing and enlarging drawings in 15 ratios, from 2:1 to 16:1 or vice-versa; in plain box, with Directions . . . . . each $



No. 1144.

1144. Pantograph of polished Hardwood, fancy lined, bars 21 in , metal foot, tracer and lead point interchangeable; for reducing and enlarging drawings in 34 ratios, from 8:1 to 1/4 : 1 or vice-versa; in plain box, with Directions . . . . . each $

1145. Pantograph do. do. do. but bars 41 in. and joints formed by bolts and thumb nuts . "

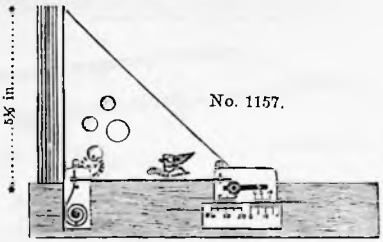


No. 1149.

1148. Pantograph of Hardwood, nickelplated mountings, adjustable lead, bars 21 in.; for reducing and enlarging drawings in 25 ratios, 8: 1 to 1/4: 1; in plain box, with Directions, ... each $

1149. Pantograph of Hardwood, nickelplated mountings, lead pencil and tracer interchangeable, in tubular holders, bars 21 in.; for reducing and enlarging drawings in 18 ratios, from 8: 1, to 1/2: 1; in plain box, with Directions. . . . . "

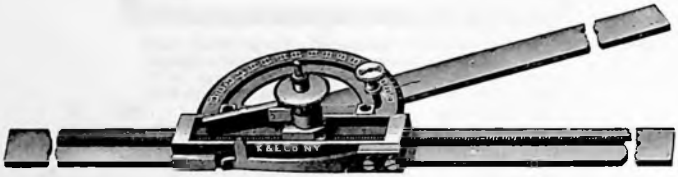
SECTION LINERS.



1157. Casey's Section Liner, triangle of Xylonite (transparent), straightedge of boxwood, nickel silver Mountings, a very reliable and simple instrument. There is hardly any practice required to operate it to perfection. By the 2 scales with verniers, on the metal plates, the distances are regulated to $\frac{1}{100}$th inch or $\frac{1}{10}$th millimeter, ... each $

BOTH'S PATENT

SECTION LINER AND SCALE DIVIDER.



No. 1160.

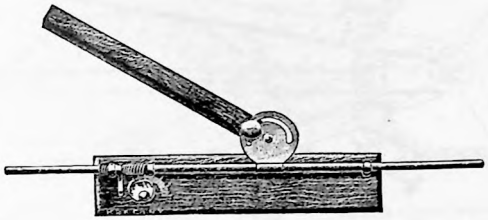
1160. Both's Patent Section Liner and Scale Divider, nickel silver, base 14¾ in. Protractor graduated to degrees, with Vernier reading to five minutes. Instrument in wooden Case, with full Directions for setting and using . each $

Both's Patent Section Liner and Scale Divider is the easiest to manipulate, the most rapid and exact in execution, the finest in workmanship and the most durable of any hitherto known.

The essential parts of Both's Patent Section Liner are: a flat rack bar 14¾ in. long, bearing an accurately cut rack 9 in. long with 24 teeth to the inch, and a nicely fitted carriage made to slide on the rack bar; to this are attached the semi-circular protractor graduated to degrees, the pivoted ruler arm extending 10 in. beyond the protractor, and the mechanism for uniformly advancing the ruler arm. This mechanism consists of a steel pawl which engages in the teeth of the rack bar, taking from one to six teeth at a time, according to the take-up to which the adjusting nut has been set. The slide and with it the ruler arm, are made to advance on the rack bar by pressing on a knob which causes the pawl to engage in a tooth of the rack.

The comfort and satisfaction attending the use of this instrument, the assurance of being able to do absolutely accurate work in less time than with any other, its easy adjustment for section-lining or for scales, its great scope, together with durability and neatness, make it without exception a superior instrument and a valuable and most useful addition to the outfit of every draughtsman who knows and appreciates the value of good tools.

SIMPLEX SECTION LINER.



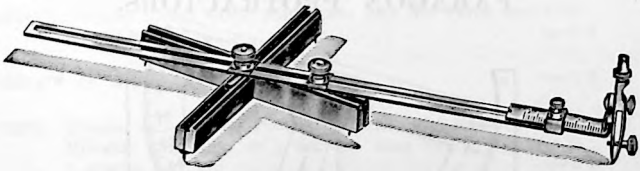
No. 1166.

1166. Simplex Section Liner, hardwood base, rod 15 in., rule 7 in., held on the drawing by pins at bottom of base . . . . each $

1166C. Simplex Section Liner, like No. 1166, but with heavy transparent xylonite arm in place of wooden arm . . . . . "

The Simplex is a simple section liner with which fairly good work can be done. It will space up to about ⅛ in. and is very easy to handle.

ELLIPSOGRAPH.



No. 1181.

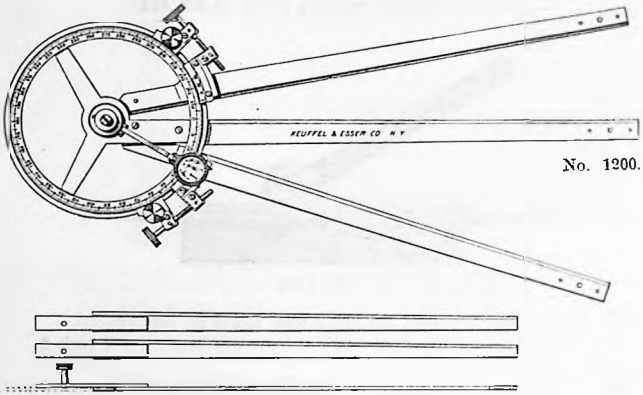
1179. Ellipsograph, brass, nickelplated, fine quality, 6 in. bar, with pen and pencil point (in one piece). In case, . . . each $

This instrument draws ellipses of any shape, from 4 inches to 11 inches major axis, with great accuracy. Its construction is shown by the illustration. The pen-pencil point can be taken off and stored compactly in the case.

1181. Ellipsograph, like No. 1179, but with 9 in. bar. In case, . . each $

This instrument draws ellipses of any shape, from 6 inches to 18 inches major axis, with great accuracy.

METAL PROTRACTORS.

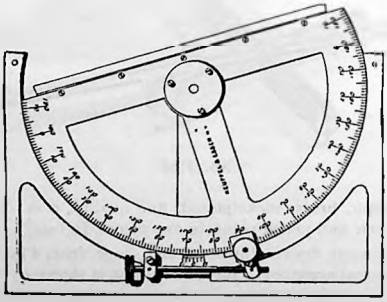


No. 1200.

1200. Three-Arm Protractor or Station Pointer; Instrument in Hardwood Case, with Screwdriver . . . . . each $

Protractor as made by us for the U. S. Navy. Bronze Circle 6½ in., divided on *solid silver* to half degrees, numbered in opposite directions from 0 to 350 and from 360 to 10, with 2 verniers reading to 1 minute. Both verniers with tangent screw. Magnifying lens on central arm. Two interchangeable Tubular Centers ⅞ in. diameter, with glass bottom, removable cylinder for center with spring point for marking center exactly. Three nickel silver arms, 17 in. long, each with extension piece with setscrew to lengthen to 27½ in. beyond edge of circle.

PARAGON PROTRACTORS.

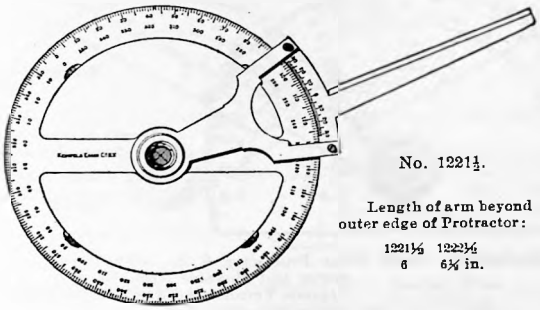


No. 1210.

1210. Crozet Protractor, 8 in., nickel silver, divided to ¼ degrees, small Horncenter, Vernier reading to 1 minute, with tangent screw; in velvet-lined Case . . . . . each $

This is a very practical protractor. When used along a straightedge or T square angles are set off without bringing the center over the starting point.

PARAGON PROTRACTORS.



No. 1221½.

Length of arm beyond outer edge of Protractor:

1221½ 1222½
6 6¾ in.

1221½. Circular nickel silver Protractor, 8 in., with Horncenter and Movable Arm, div. to ½ degrees, long Vernier reading to 1 minute, ... each $

1221½M. do. do. but in Mahogany Case, ... each $

1221½T. Circular nickel silver Protractor, like No. 1221½, but with Tangent Screw. . . . . each $

1221½TM. do. do. but in Mahogany Case, ... each $

1222½. Circular nickel silver Protractor, 10 in., with Horncenter and Movable Arm, div. to ½ degrees, long Vernier reading to 1 minute, ... each $

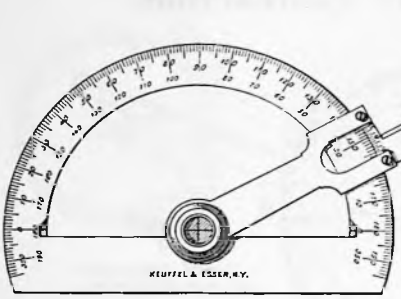
1222½M. do. do. but in Mahogany Case, ... each $

1222½T. Circular nickel silver Protractor, like 1222½, but with Tangent Screw. . . . . each $

1222½TM. do. do. but in Mahogany Case, ... each $

Polished Mahogany Case for Nos. 1221½, 1222½, 1221½T, 1222½T. each $

PARAGON PROTRACTORS.



No. 1225.

Length of arm beyond outer edge of Protractor:

1225	1226	1227
5½	6	6½ in.

1225. Semicircular nickel silver Protractor, 6 in., with Horn-center and Movable Arm, div. to ½ degrees, Vernier read'g to 5 minutes, each $

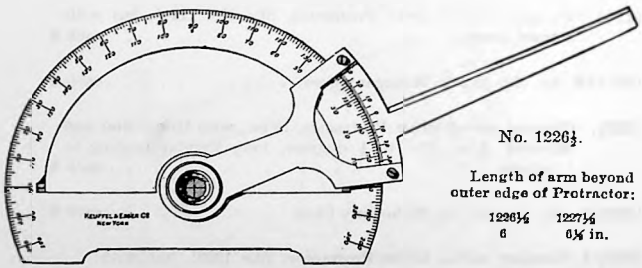
1225M. do. do. but in Mahogany Case, ... "

1226. Semicircular nickel silver Protractor, 8 in., with Horn-center and Movable Arm, div. to ½ degrees, Vernier read'g to 1 minute, "

1226M. do. do. but in Mahogany Case, ... "

1227. Semicircular nickel silver Protractor, 10 in., with Horn-center and Movable Arm, div. to ½ degrees, Vernier read'g to 1 minute "

1227M. do. do. but in Mahogany Case, ... "



No. 1226½.

Length of arm beyond outer edge of Protractor:

1226½	1227½
6	6½ in.

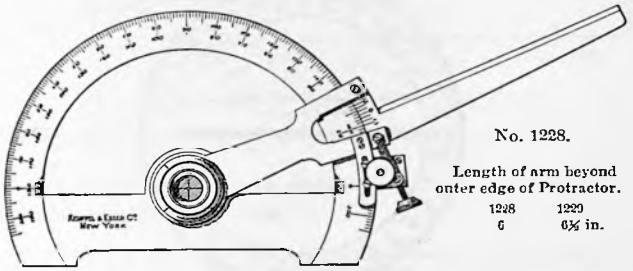
1226½. Semicircular nickel silver Protractor, 8 in., with Horn-center and Movable Arm, div. to ½ degrees, Vernier read'g to 1 minute, each $

1226½M. do. do. but in Mahogany Case, ... "

1227½. Semicircular nickel silver Protractor, like No. 1226½ but 10 in., ... "

1227½M. do. do. but in Mahogany Case, ... "

PARAGON PROTRACTORS.



No. 1228.

Length of arm beyond outer edge of Protractor.

1228	1229
6	6½ in.

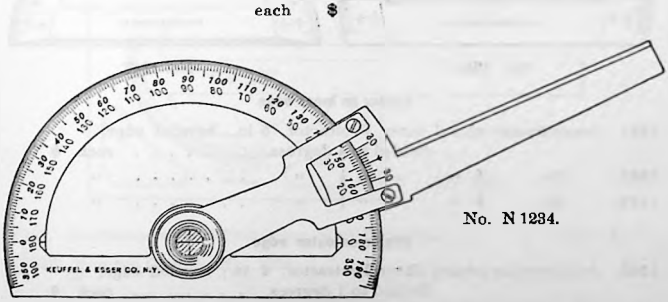
1223. Semicircular nickel silver Protractor with **Tangent Screw** 8 in., div. to ½ degrees, Vernier read'g to 1 minute, ... each $

1228 M. do. do. but in Mahogany Case, ... "

1229. Semicircular nickel silver Protractor like No. 1228, but 10 in., ... "

1229 M. do. do. but in Mahogany Case. . . . . "

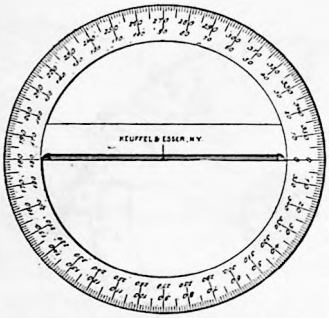
Polished Mahogany Case for Nos. 1225, 1226, 1226½, 1227, 1227½, 1228, 1229, each $



No. N 1234.

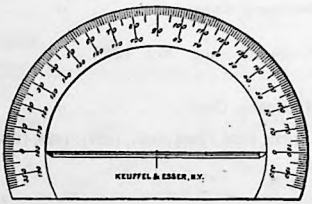
N1234. Semicircular nickel silver Protractor, 5 in., divided to half degrees, with Vernier reading to 5 minutes, small Horncenter, Movable Arm extending 3 inches beyond outer edge; in Box, ... each

PARAGON PROTRACTORS.

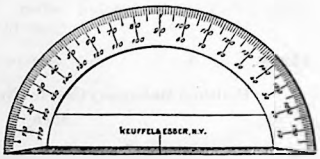


No. N 1235.

N1235. Circular nickel silver Protractor, 6 in., beveled edge, divided to ½ degrees . . . . . each $



No. 1242.



No. 1247.

Center on inner edge

1241. Semicircular nickel silver Protractor, 5 in., beveled edge, divided to ½ degrees, ... each $

1242. do. 6 " " " ½ " . . . . . "

1243. do. 6 " " " ¼ " . . . . . "

Center on outer edge

1245. Semicircular nickel silver Protractor, 4 in., beveled edge, divided to 1 degrees, ... each $

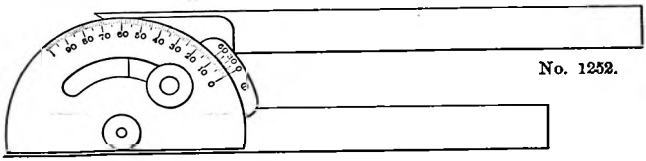
1246. do. 5 " " " ½ " . . . . . "

1247. do. 6 " " " ½ " . . . . . "

1248. do. 6 " " " ¼ " . . . . . "

1250. do. 8 " " " ½ " . . . . . "

LIMB PROTRACTORS.



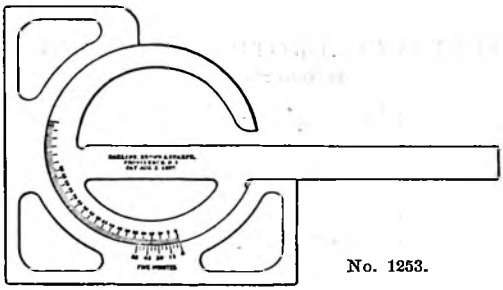
No. 1252.

1252. Machinist's Limb Protractor, steel . . . . . each $

1252C. Mahogany Case for No. 1252 . . . . . "

This Protractor has blades about 9 inches long. The arc is of 4 in. diameter, graduated to degrees, with vernier reading to 5 minutes. A clamping screw securely holds the blades at any angle and serves as knob handle.

Either blade can be used against a T square, giving any angle and its complement from 0° to 90°, so that it is practically an adjustable triangle.



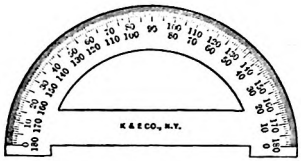
No. 1253.

1253. Draftsman's Steel Protractor, with Directions . . . . . each $

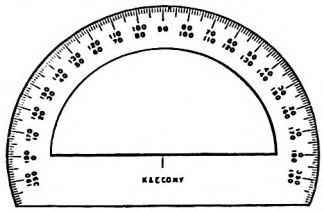
1253C. Morocco Case for No. 1253 . . . . . "

This Protractor is of sheet steel, graduated on one side to degrees, with vernier reading to 5 minutes. The blade is 8 ½ inches long. It is used chiefly in connection with a T square or Straight Edge. Being perfectly flush on both sides, it can be used either side up and on either edge of the blade. This makes it particularly convenient in dividing circles, transferring angles, drawing oblique lines at right angles to each other or laying off given angles on each side of a line without changing the setting.

PLAIN METAL PROTRACTORS.



Nos. 1261 and 1267.



1271.

Nickel Silver.

1258. Highgrade Semicircular Protractor, 4¼ in., div. to ½ degrees, each $

1260.	Semicircular	Protractor,	4¼	"	"	" 1	"	"
1261.	do.	do.	5¼	"	"	" 1	"	"
1263.	do.	do.	7¼	"	"	" ½	"	"

Brass.

1265.	Semicircular	Protractor,	3¾	in.,	divided to	1	degrees, .	each $
1266.	do.	do.	4¼	"	"	" 1	"	"
1267.	do.	do.	5¼	"	"	" 1	"	"

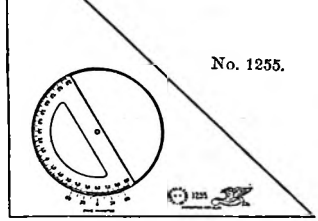
Brass "White Enameled."

1270.	Semicircular	Protractor,	3¾	in.,	divided to	1	degrees, .	each $
1271.	do.	do.	4½	"	"	" 1	"	"

The advantage of the brass "white enameled" protractor over the ordinary brass protractor lies in the fact that in the "white enameled" protractor the black graduations and numbers stand out prominently against a white background; this facilitates reading and obviates the possibility of errors.

ADJUSTABLE PROTRACTOR TRIANGLE.

Belcher's Patent.



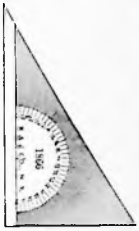
No. 1255.

1255. Adjustable Protractor Triangle, 8 in. xylonite, (transparent), 45°×45°×90° . . . . . each $

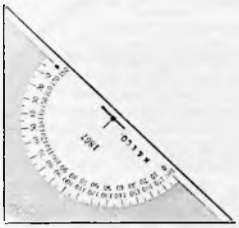
The semicircular protractor, 3½ in. diam., is graduated to single degrees, numbered 0-90 at every 10 degrees in both directions, double vernier reading to 5 minutes. It revolves in a circular groove, where it is held by a spring. The triangle and protractor are flush on both sides so that either side can be used for drawing slopes in opposite directions, etc. The base line of the protractor has a drawing edge.

XYLONITE PROTRACTORS.

(Transparent)



No. 1866.



1867.



1868

1866. Xylonite Protractor Triangle, 30 × 60°, 6 in., div. to 1° each $

1867. Xylonite Protractor Triangle, 45°, 5 " " 1° "

" " " " 7 " " 1° "

1868. Xylonite Semicircular Protractor, flat, 4 in., div. to 1° "

" " " " 5 " " ½° "

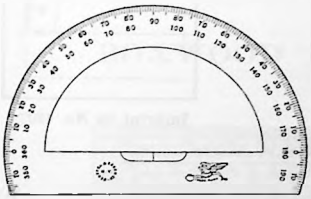
" " " " 6 " " ½° "

" " " " 8 " " ½° "

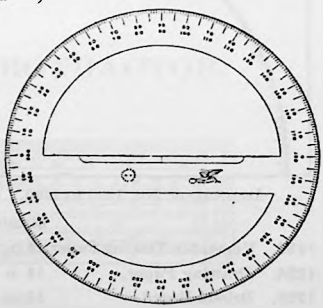
" " " " 10 " " ½° "

BEVELED EDGE.

(Transparent)



No. 1869.



1872.

1869. Semicircular Xylonite Protractor, beveled edge, 6 in., ½°, each $

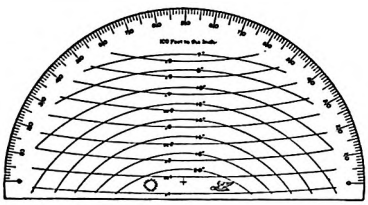
1870. do. do. do. " " 8 " ½° "

1871. Circular do. do. " " 6 " ½° "

1872. do. do. do. " " 8 " ½° "

1873. do. do. do. " " 10 " ½° "

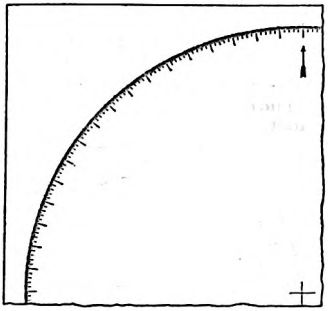
RAILROAD CURVE PROTRACTOR.



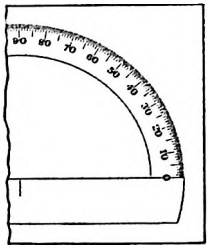
No. 1878. (Transparent)

1878. Xylonite Railroad Curve Protractor, 10 in., divided to half degrees. with circular Curves, 1°, 1½°, 2°, 2½°, 3°, 3½°, 4°, 5°, 6°, 7°, 8°, 10°, 12°, 14°, 16°, 18°, 20°; scale 100 feet = 1 inch.. . . . . each $

PAPER PROTRACTORS.



Imprint on No. 1293 to 1295.



Imprint on No. 1297.

Circular, 14 in.

1293. Vegetable Tracing Paper, 14 in. diam. div. ¼°, Sheet 15½x21 in., each $

1294. Drawing Paper, 14 " " " ¼° " 15½x20 " "

1295. Bristol Board, 14 " " " ¼° " 16½x20 " "

Circular, 8 in.

1296. Bristol Board, 8 in. diam. div. ½°, Sheet 10 x12 in., each $

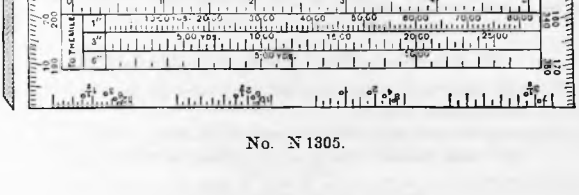
1296T. Vegetable Tracing Paper, 8 " " " ½° " 9½x12 " "

Semicircular, 5 in.

1297. Bristol Board, 5 in. diam. div. ½°, Sheet 5½ x 7 in., ... each $

MILITARY PROTRACTOR.

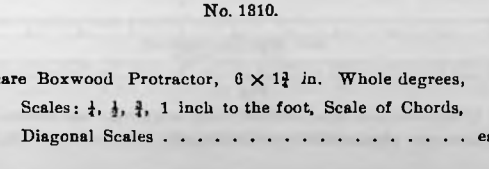
(TRANSPARENT)



No. N 1305.

N1305. Square Xylonite (transparent) Protractor, $6 \times 1\frac{3}{4}$ in., beveled edges, whole degrees. Scales, 1, 2, 3 and 4 in. to the mile, reading to yards. Scale of Chords. Scale of inches in tenths on lower edge . . . . . each $

BOXWOOD PROTRACTOR.



No. 1810.

1310. Square Boxwood Protractor, $6 \times 1\frac{3}{4}$ *in.* Whole degrees, Scales: $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 inch to the foot, Scale of Chords, Diagonal Scales . . . . . each $

PARAGON AND BOXWOOD SCALES

Machine-divided. U. S. St'd.

The U. S. St'd. machine-divided Paragon and Boxwood Scales manufactured by us, are of the best selected material, of proper width and thickness, and of finest finish. They are for quality and accuracy superior to any others on the market.

Although we list and carry in stock a very large assortment of scales, we are often called upon to make

SPECIAL SCALES TO ORDER.

To avoid error and tedious and delaying correspondence, we give directions for ordering such Scales.

There are two distinctly different ways of dividing a scale:

the **"open divided"** and the **"full divided or Chain Scale."**

OPEN DIVIDED SCALES

are illustrated under *A*, *B*, *C*. They are generally used in **architectural** or **mechanical** drawing, and are divided into inches or parts of inches, which represent feet or full inches. The units are marked along the whole length of the edge and only the end units are subdivided into inches and fractions.

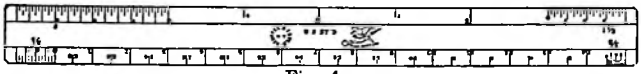


Fig. *A*.

Fig. *A* represents an open divided Scale with **four different divisions,** two on each edge. Two of these divisions are numbered to read from the right, the other two from the left. (When two divisions are to be placed on one edge, one must be the double of the other, like $\frac{1}{8} \times \frac{1}{4}$, $\frac{3}{8} \times \frac{3}{4}$, 2×4, etc.)



Fig. *B*.

Fig. *B* represents an open divided Scale with **two different divisions,** one on each edge; each edge reading from right to left and from left to right.



Fig. *C*.

Fig. *C* represents an open divided Scale with only **one division,** the same on both edges; one edge reads from right to left, the other from left to right.

In ordering open divided Scales it is, therefore, necessary to state that they are to be open divided; length, shape and material, how many different divisions are wanted, which on each edge and whether the numbers should read from right to left, or from left to right or both ways, should also be specified. Of course, they can read both ways only when there is but one division on each edge. If other than the usual numbering is wanted, this must also be explained in the order.

FULL DIVIDED OR CHAIN SCALES

are those on which equal divisions and subdivisions are carried along the whole length of the divided part. Therefore, only one kind of division can be made on one edge. They are generally divided into decimals of inches or feet, continuous numbering every 10 divisions, and are used by **Surveyors** and **Civil Engineers**, but they can be divided inches to the foot, as shown in figure *E*.

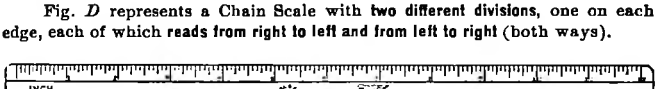


Fig. *D*.

Fig. *D* represents a Chain Scale with **two different divisions**, one on each edge, each of which **reads from right to left and from left to right** (both ways).

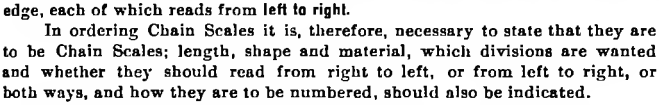


Fig. *E*.

Fig. *E* represents a Chain Scale with **two different divisions**, one on each edge, each of which reads from **left to right**.

In ordering Chain Scales it is, therefore, necessary to state that they are to be Chain Scales; length, shape and material, which divisions are wanted and whether they should read from right to left, or from left to right, or both ways, and how they are to be numbered, should also be indicated.

The price of special scales to order depends on so many factors, that it is not feasible to give any directions for estimating their cost. We shall be pleased to quote a price on receipt of an accurate description of the scale wanted.

The safest way to order a Special Scale is to use our printed forms for ordering scales, which are furnished on request. In the absence of a printed form, state material, shape and length of scale wanted, and send a sketch showing divisions and numbering. It is not necessary that the sketch should show correct or actual divisions, if the value of the divisions (in inches, etc.) is stated and the divisions and numberings are indicated.

Bevels on opposite side.

We furnish any of our flat scales with the two bevels on opposite sides and carry some of the more frequently used scales of this style in stock. (See No. 1391PR. &c.)

Scales with any divisions, also in foreign measures, made to order.

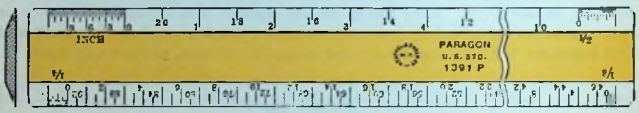
OPEN DIVIDED PARAGON SCALES.

Machine Divided, U. S. St'd.

Each Scale Stamped Paragon.

Paragon Scales are made of the best seasoned Boxwood. The bevels are coated with a material resembling ivory, which will permanently remain white and is not liable to shrink. They combine durability and distinctness, and will not tire nor injure the eyes.

DIVIDED: INCH TO THE FOOT.



No. 1391 P.

1390 P. Flat Paragon Scale, 6 in. div. $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 in. to the foot, each $

1391 P. do. 12 " " " " " " " " " " " "

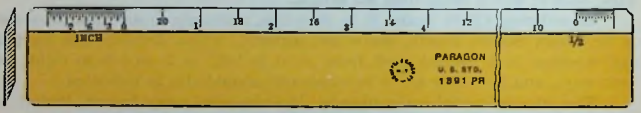
1391 PA. do. 12 " " $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{3}{4}$, " " " " " "

1391 PB. do. 12 " " $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{4}$, $1\frac{1}{2}$, " " " " " "

1392 P. do. $12\frac{1}{2}$ " " $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, " " " " " "

Scale No. 1392P has the advantage of covering 100 feet on $\frac{1}{8}$ inch, 50 feet on $\frac{1}{4}$ inch, and 25 feet on $\frac{1}{2}$ inch scale.

1394 P. Flat Paragon Scale, 24 in., div. $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 in. to the foot, each $



No. 1391 PR.

Bevels on Opposite Sides.

1391 PR. Flat Paragon Scale, 12 in., div. $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 in. to the foot, each $



No. 1396 P.

1396 P. Flat Paragon Scale, 12 in. div. $\frac{3}{8}$, $\frac{3}{4}$, $1\frac{1}{2}$, 3 in. to the foot, each $

Flat Paragon Scales with other divisions, one or both sides divided, made to order, see page 120

KEUFFEL & ESSER CO.

ORDER FOR SPECIAL SCALES.

Please read all questions and answer all that apply to the scale wanted

Flat Scales.

Of what material is the scale to be? **Boxwood? Paragon** (white lined)?

Of which cross-section?.....



2 bevels 4 bevels opposite bevels 1 bevel

What is length of scale to be? (State length of graduated part, not of the blank, unless special length blank is wanted.).....

How is each edge to be graduated and numbered?:

Edge 1.....

" 2.....

" 3.....

" 4.....

If inch to the foot, is it to be open divided or continuous .....

In which direction is each edge to be numbered? from **right to left? from left to right? both ways?**.....

Are there any special directions about relative length of graduation marks?

.....

Remarks .....

.....

.....

.....

It is always safest to send a sketch. This need not be accurate if the *value* of the divisions (units) is stated and the divisions and numberings are indicated.

OVER

Blank for ordering special scales. ADDITIONAL BLANKS WILL BE FURNISHED ON REQUEST.

Triangular Scales.

Of what material is the scale to be? Boxwood? Paragon (white lined)?

Of which cross-section? 

What is the length of the scale to be? (State length of graduated part, not of the blank, unless special length blank is wanted.).....

How is each edge to be graduated and numbered?:

Edge 1.....

" 2.....

" 3.....

" 4.....

" 5.....

" 6.....

If inch to the foot, is it to be open divided or continuous?.....

In which direction is each edge to be numbered? from right to left? left to right? both ways?.....

Are there any special directions about relative length of graduation marks?

.....

Remarks .....

.....

.....

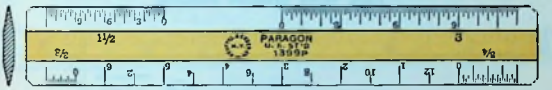
.....

It is always safest to send a sketch. This need not be accurate if the *value* of the divisions (units) is stated and the divisions and numberings are indicated.

OVER.

OPEN DIVIDED PARAGON SCALES.

Each Scale Stamped Paragon.

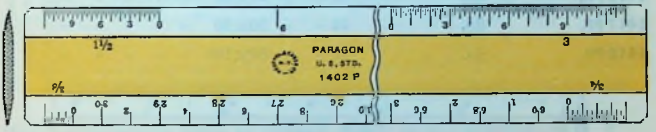


No. 1399 P.

Both sides beveled and divided.

1399 P. Flat Paragon Pocket Scale, 6 in., div. $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $1 \times \frac{3}{8}$, $\frac{3}{4}$, $1\frac{1}{2}$, 3 in. to the foot; in leather Sheath . . . . . each $

Scale 1399 P. is less than one inch wide and very convenient for the pocket. It has all the usual scales employed by the building professions.



No. 1402 P.

Both sides beveled and divided.

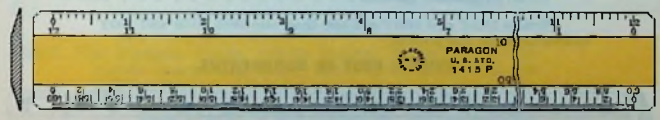
1400 P. Flat Paragon Scale, 12 in., div. $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $1 \times \frac{3}{8}$, $\frac{3}{4}$, $1\frac{1}{2}$, 3 in. to foot, each $

1402 P. " 24 " " " " " " " " " " " " "

PARAGON CHAIN SCALES.

Machine Divided, U. S. St'd.

DIVIDED: INCHES AND TENTHS.



No. 1415 P.

1410 P. Flat Paragon Chain Scale, 6 in., div. 10×50 parts to the inch, each $

1411 P. do. 6 " " 20×40 " " " " "

1412 P. do. 6 " " 30×60 " " " " "

1413 P. do. 6 " " 80×100 " " " " "

1415 P. do. 12 " " 10×50 " " " " "

1416 P. do. 12 " " 20×40 " " " " "

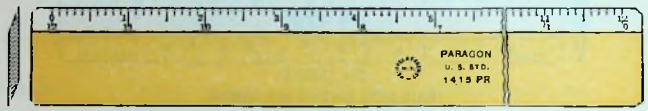
1417 P. do. 12 " " 30×60 " " " " "

1418 P. do. 12 " " 80×100 " " " " "

Flat Paragon Scales with other divisions, one or both sides divided, made to order, see page 120.

PARAGON CHAIN SCALES.

Each Scale Stamped Paragon.



No. 1415 PR.

Bevels on opposite sides.

1415 PR. Flat Paragon Chain Scale, 12 in. div. 10×50 parts to the in., each $

1416 PR. do. 12 " " 20×40 " " " " "

1417 PR. do. 12 " " 30×60 " " " " "

1418 PR. do. 12 " " 80×100 " " " " "



No. 1419 P.

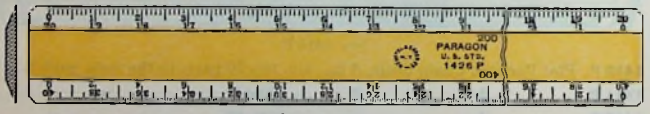
Both sides beveled and divided.

1419 P. Flat Paragon Pocket Scale, 6 in., div. 10, 40, 30 and 50 parts to the inch; in leather Sheath. . . . . each $

1420P. do. do. 6 in., div. 10, 20, 40 and 50 parts to inch; in leather Sheath . . . . . "

Scales 1419 P and 1420 P are less than one inch wide and very convenient for the pocket.

DIVIDED: FOOT IN HUNDREDTHS.



No. 1426 P.

1425 P. Flat Paragon Chain Scale, 12 in., div. 100×500 parts to the foot, each $

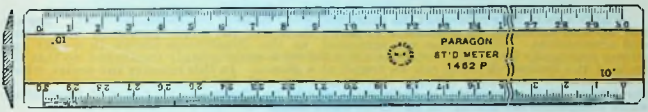
1426 P. do. 12 " " 200×400 " " " " "

1427 P. do. 12 " " 300×600 " " " " "

1428 P. do. 12 " " 800×1000 " " " " "

Flat Paragon Scales with other divisions, one or both sides divided, made to order, see page 120.

PARAGON SCALES.



No. 1462 P.

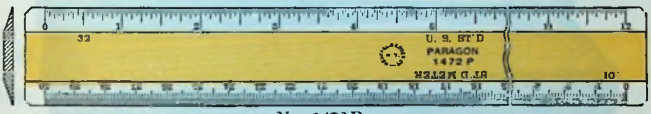
1460 P. Flat Paragon Scale, 10 cm., div. mm. and half mm . . . . each $

1461 P. do. 20 " " " " " " " . . . . "

1462 P. do. 30 " " " " " " " . . . . "

1463 P. do. 50 " " " " " " " . . . . "

DIVIDED: INCHES AND METRIC MEASURE.



No. 1472 P.

1472 P. Flat Paragon Scale, 30 cm., div. 32nds. in. and half mm., each $

1473 P. do. 50 " " " " " " " " "

These scales are divided into inches on one edge and into metric measure on the other, which makes them very convenient for converting plans from one system into the other.

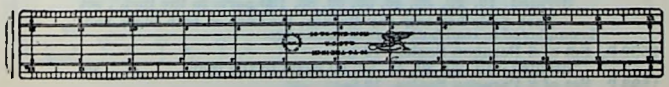
METRIC COMPARING SCALES.



No. 1482 P.

1482 P. Flat Paragon Scale, (white facing) 30 cm., inch and metric comparing scale, div. mm. and 16ths in. on median line, (no bevels) . . . . . each $

UNDERWRITER'S SCALES.



No. 1487.

1486. Underwriter's Scale, flat, transparent xylonite, 6 in., both edges beveled, one edge divided 10 parts to the inch, the other 50 parts to the inch; the inch graduations are carried across the scale . . . . . each $

1487. Underwriter's Scale, flat, like No. 1486, but 12 in. . . . "

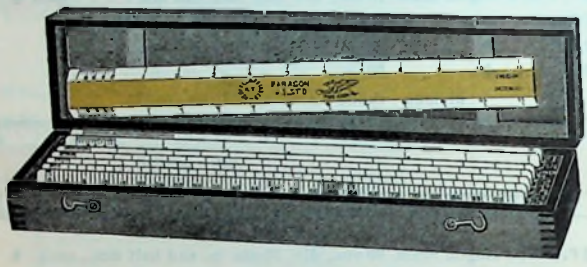
Flat Paragon Scales with other divisions, one or both sides divided, made to order, see page 120.

For Scales for Indicator Diagrams, see page 254.

PARAGON SCALES IN SETS.

Flat Scales in Sets represent the most perfected form of Draftsman's Scales. They are put up and arranged in a manner to make their use the most practical, time saving and economical. The Scales are arranged as the illustration shows, in a neat and strong mahogany box with a separate space for each scale plainly numbered so that the scale of the desired division can be found at a glance. In this manner the scales, which are as valuable and more delicate than compasses and dividers, are protected as well as the latter. It is unreasonable that scales should be allowed to take care of themselves while compasses are preserved in velvet-lined cases.

Each Scale Stamped Paragon.



No. 1576 P.

PARAGON SCALES, OPEN DIVIDED.

Each Scale has the same division on both edges, one edge reading from left to right, the other edge from right to left. See figure C, page 120:

1575 P. Set of 4 Paragon Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 inch to the foot . . . . . set $

1576 P. Set of 8 Paragon Scales, 12 in.
divided: $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{8}$, $\frac{3}{4}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 3 inches to the foot . . . "

1577 P. Set of 12 Paragon Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2, 3, 4, 6 inches to the foot and $\frac{1}{12}$ inch full size "

PARAGON CHAIN SCALES.

Each Scale has two different divisions, one on each edge, each of which is numbered to read both ways. See figure D, page 121.

1584 P. Set of 4 Paragon Scales, 12 in.
divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch . set

Each Scale has only one division, the same on both edges, and is numbered to read both ways on each edge.

1592 P. Set of 6 Paragon Scales, 12 in.
divided: 10, 20, 30, 40, 50, 60 parts to the inch . . . . set

1593 P. Set of 8 Paragon Scales, 12 in.
divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch. "

PARAGON METRIC SCALES.

1598 P. Set of 6 Paragon Scales, 30 cm.
divided metric measure: .01 .02 .03 .05 .025 .0125 . . "

1599 P. Set of 6 Paragon Scales, 50 cm.
divided metric measure: .01 .02 .03 .05 .025 .0125 . . "

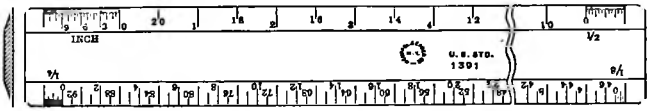
Sets of Scales with other divisions made to order. See page 120.

For Boxwood Scales in Sets, see page 131.

FINE QUALITY BOXWOOD SCALES.

Machine Divided, U. S. St'd.

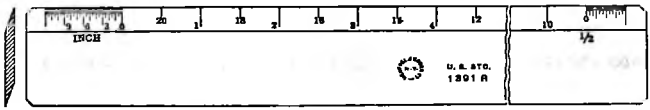
DIVIDED: INCH TO THE FOOT.



No. 1391.

1390. Flat Boxwood Scale, 6 in., div. $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 in. to the foot, . . each $

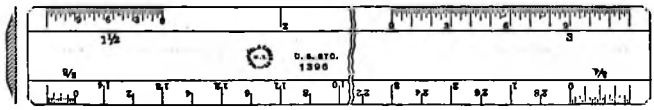
1391. do. 12 " " " " " " " " " " . . "



No. 1391 R.

Bevels on opposite sides.

1391 R. Flat Boxwood Scale, 12 in., div. $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 in. to the foot, each $



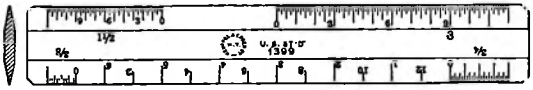
No. 1396.

1396. Flat Boxwood Scale, 12 in., div. $\frac{1}{2}$, $\frac{3}{4}$, $1\frac{1}{2}$, 3 in. to the foot, . each $

Flat Boxwood Scales with other divisions, one or both sides divided, made to order, see page 120.

For Flat Paragon Scales, see pages 122 etc.

FINE QUALITY BOXWOOD SCALES.

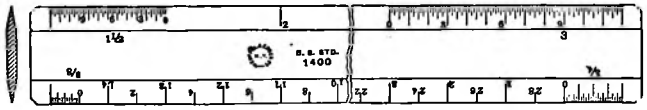


No. 1399.

Both sides beveled and divided.

1399. Flat Boxwood Pocket Scale, 6 in., $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $1\times\frac{1}{8}$, $\frac{3}{4}$, $1\frac{1}{2}$, 3 in. to the foot; in leather Sheath . . . . . each $

Scale 1399 is less than one inch wide, and very convenient for the pocket. It has all the scales usually employed by the building professions.



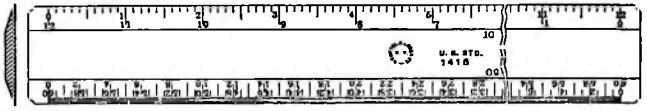
No. 1400.

Both Sides Beveled and Divided.

1400. Flat Boxwood Scale, 12 in., div. $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $1\times\frac{1}{8}$, $\frac{3}{4}$, $1\frac{1}{2}$, 3 in. to ft. each $

CHAIN SCALES

DIVIDED: INCHES AND TENTHS.



No. 1415.

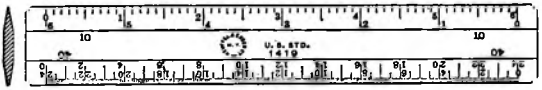
1410. Flat Boxwood Chain Scale, 6 in., div. 10×50 parts to the inch, each $

1411.	do.	do.	6	"	"	20×40	"	"	"	"
1412.	do.	do.	6	"	"	30×60	"	"	"	"
1415.	do.	do.	12	"	"	10×50	"	"	"	"
1416.	do.	do.	12	"	"	20×40	"	"	"	"
1417.	do.	do.	12	"	"	30×60	"	"	"	"

Flat Boxwood Scales with other divisions, one or both sides divided, made to order, see page 120.

For Flat Paragon Scales, see pages 122 etc.

FINE QUALITY BOXWOOD SCALES.



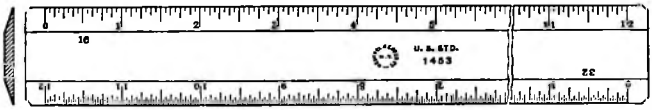
No. 1419.

1419. Flat Boxwood Pocket Scale, 6 in., **both sides beveled and divided,** div. 10, 40, 30 and 50 parts to the inch; in leather Sheath, each . . . . . $

1420. Flat Boxwood Pocket Scale, 6 in., **both sides beveled and divided,** div. 10, 20, 40 and 50 parts to the inch; in leather Sheath, each . . . . . $

Scales 1419 and 1420 are less than one inch wide and very convenient for the pocket.

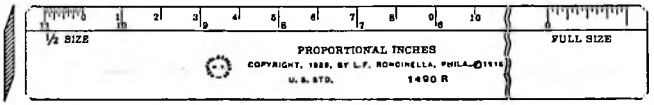
MISCELLANEOUS DIVISIONS.



No. 1453.

1450. Flat Boxwood Chain Scale, 12 in., div. 10×12 parts to the inch, each $

1452.	do.	do.	12 "	"	12×16	"	"	"	"	"
1453.	do.	do.	12 "	"	16×32	"	"	"	"	"
1454.	do.	do.	12 "	"	32×64	"	"	"	"	"
1480.	do.	do.	6 "	"	16ths in. × mm.					"
1481.	do.	do.	12 "	"	"	"	× "			"



No. 1490 R.

1490 R. Flat Boxwood Scale, 12 in., div. Proportional Inches, **bevels on opposite sides** . . . . . each $

This Scale is designed especially for the use of Mechanical and Machine Draftsmen. It contains the Scales most used in practice: ⅛, ¼, ½ and full size in inches, two scales on each edge, with the unit beyond the zero point subdivided.

For Scales for Indicator Diagrams, see page 254.
For Flat Paragon Scales, see pages 122 etc.

FINE QUALITY BOXWOOD SCALES.

DIVIDED: METRIC MEASURE.



No. 1550.

1530. Flat Boxwood Scale, 10 cm. div. mm. and half mm. . . . each $

1540. do. 20 " " " " " " " . . . . . "

1550. do. 30 " " " " " " " . . . . . "

1560. do. 50 " " " " " " " . . . . . "

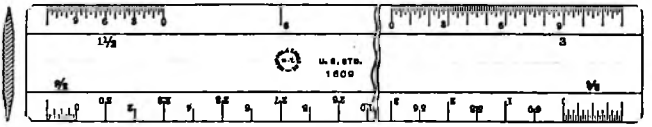
PLAIN FLAT BOXWOOD SCALES.



No. 1606.

1605. Flat Boxwood Scale, 6 in., div. $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 in. to the foot . each $

1606. do. 12 " " " " " " " " " " . " "



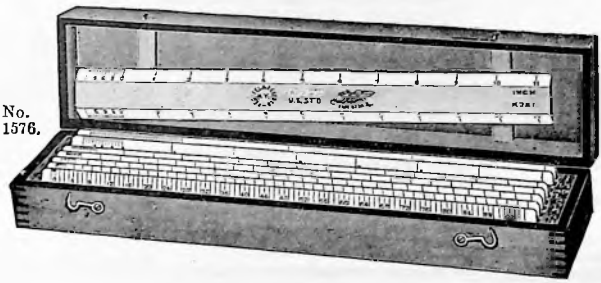
No. 1609.

1609. Flat Boxwood Scale, 12 in., $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1×$\frac{3}{8}$, $\frac{3}{4}$, 1$\frac{1}{2}$, 8 in. to the foot, each $

For Scales for Indicator Diagrams, see page 254.
For Flat Paragon Scales, see pages 122 etc.

FINE QUALITY BOXWOOD SCALES IN SETS.

No. 1576.



OPEN DIVIDED SCALES.

Each Scale has the same division on both edges, one edge reading from left to right, other edge from right to left. See figure C, page 120.

1575. Set of 4 Boxwood Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 inch to the foot . . . . . set $

1576. Set of 8 Boxwood Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 3 inches to the foot . "

1577. Set of 12 Boxwood Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2, 3, 4, 6 inches to the foot, and $\frac{1}{16}$ inch full size . . . . . "

CHAIN SCALES.

Each Scale has two different divisions, one on each edge, each of which is numbered to read both ways. See figure D, page 121.

1584. Set of 4 Boxwood Scales, 12 in.
divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch—set $

Each Scale has only one division, the same on both edges, and is numbered to read both ways on each edge.

1592. Set of 6 Boxwood Scales, 12 in.
divided: 10, 20, 30, 40, 50, 60 parts to the inch . . . set $

1593. Set of 8 Boxwood Scales, 12 in.
divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch "

METRIC SCALES.

1598. Set of 6 Boxwood Scales, 30 cm.
divided: metric measure .01, .02, .03, .05, .025, .0125 "

1599. Set of 6 Boxwood Scales, 50 cm.
divided: metric measure .01, .02, .03, .05, .025, .0125 "

Sets of Scales with other divisions made to order, see page 120.

For Paragon Scales in Sets, see page 126.

TRIANGULAR PARAGON SCALES.

MACHINE DIVIDED. U. S. ST'D.



Improved shape — Usual shape.

The Paragon Scales have the improved shape, shown in above cut, which prevents the divisions wearing off by friction and insures better contact with the drawing and a better angle of vision. The bevels bearing the divisions are lined with a material resembling ivory, like the Flat Paragon Scales.

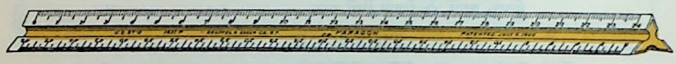
Each Scale Stamped Paragon.



No. 1621 P.

Triangular Paragon Scales, Architect's.

1620 P.	6 in., div. $\frac{3}{32}$, $\frac{3}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, 1½, 3 in. to the foot, $\frac{1}{16}$ in., each	$
1621 P.	12 "	"
1622 P.	12 " " $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, 1½, 2, 3, 4 " " " " " " " "	"
1623 P.	18 "	"
1624 P.	24 "	"



No. 1631 P.

Triangular Paragon Chain Scales, Engineer's,

1630 P.	6 in., div. 10, 20, 30, 40, 50, 60 parts to the inch . . . each	$
1631 P.	12 " " " " " " " " " " " " " " " " " "	"
1632 P.	18 " " " " " " " " " " " " " " " " " "	"
1633 P.	24 " " " " " " " " " " " " " " " " " "	"
1634 P.	12 " " 20, 30, 40, 50, 60, 80 " " " " " " " "	"
1635 P.	Triangular Paragon Chain Scale, 12 in. div. 100, 200, 300, 400, 500, 600 parts to the foot	"
1637 N.P.	Triangular Paragon Scale. Mechanical Engineer's 18 in. div. 1×2, 1½×3, 4½×9, 6×18, 12×24, full size in 10ths.	"

The scales 18 and 24 in. to the foot represent enlargement or magnification, while those from 1½ to 9 in. to the foot represent reduction.

Metric Triangular Paragon Scale,

1645 P.	20 cm., div. .01 .02 .03 .05 .025 .0125 . . . . . each	$
1655 P.	30 " " " " " " " "	"
1665 P.	50 " " " " " " " "	"

TRIANGULAR BOXWOOD SCALES WITH WHITE EDGES.

MACHINE DIVIDED U. S. ST'D.



No. 1621W.

Triangular Boxwood Scales, white edges, **Architect's,**

1620 W. 6 in., div. $\frac{3}{32}$, $\frac{3}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 3 in. to the foot, $\frac{1}{16}$ in., each $

1621 W. 12 "

1622 W. 12 " " $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2, 3, 4 " " " " " " "



No. 1631W.

Triangular Boxwood Chain Scales, white edges, **Engineer's,**

1630 W. 6 in., div. 10, 20, 30, 40, 50, 60 parts to the inch . . . each $

1631 W. 12 " " " " " " " " " " " " . . . "

1633 W. 24 " " " " " " " " " " " " . . . "

1634 W. 12 " " 20, 30, 40, 50, 60, 80, " " " " . . . "

SHEATHS FOR TRIANGULAR SCALES.

In ordering, please state whether for Paragon, White Edge or Plain Boxwood Scale.

1619 A. Sheaths for 6 in. scale . . . . . each $

1619 B. do. 12 " " . . . . . "

1619 C. do. 18 " " . . . . . "

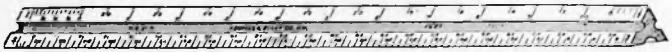
1619 D. do. 24 " " . . . . . "

These sheaths are of stout cardboard, lined with velvet.

Triangular scales of any style, with any divisions, also in foreign measures made to order. See page 120.

TRIANGULAR BOXWOOD SCALES.

MACHINE DIVIDED U. S. STD.



No. 1621.

Triangular Boxwood Scales, **Architect's,**

1620. 6 in. div. $\frac{3}{32}$, $\frac{3}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 3 in. to the foot, $\frac{1}{16}$ in., each $

1621. 12 "

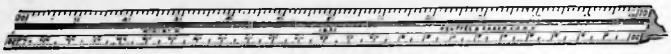
1621 M. 12 " " $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 3 in. to the foot, 50 parts to the inch, $\frac{1}{16}$ in. "

1622. 12 " " $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2, 3, 4 " " " " " " "

1623. 18 "

TRIANGULAR CHAIN SCALES. (Boxwood.)

MACHINE DIVIDED U. S. ST'D.



No. 1631.

Triangular Boxwood Chain Scales, **Engineer's,**

1630. 6 in., div. 10, 20, 30, 40, 50, 60 parts to the inch . . . . each $

1631. 12 " " " " " " " " " " " " " " . . . . "

1632. 18 " " " " " " " " " " " " " " . . . . "

1634. 12 " " 20, 30, 40, 50, 60, 80 " " " " . . . . "

Triangular Scales of any style with any divisions, also in foreign measures, made to order. **See page 120.**

For Sheaths for Scales, see page 133.

For Flat Boxwood Scales, see pages 127 etc.

TRIANGULAR BOXWOOD SCALES.

MACHINE DIVIDED U. S. ST'D.

1638. Triangular Boxwood Combination Scale, 12 in.(copyrighted by Prof. L. F. Rondinella), 1 face (flat) div.: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$ and full size (proportional inches), 1 face (grooved) $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$ inches to the foot, 1 face (grooved) 10x50 parts to the inch . . . . . each $

1637 N. Triangular Boxwood Scale, Mechanical Engineer's 18 in. div. 1×2, 1½×3, 4½×9, 6×18, 12×24, full size in 10ths. "

The scales 18 and 24 in. to the foot represent enlargement or magnification, while those from 1⅛ to 9 in. to the foot represent reduction.

METRIC TRIANGULAR SCALES. (Boxwood.)



No. 1655.

				each
1645.	Triangular Boxwood Scale,	20 cm.,	div. .01 .02 .03 .05 .025 .0125	$
1655.	do.	30 "	" " " " " " " "	
1665.	do.	50 "	" " " " " " " "	

Triangular Scales of any style with any divisions, also in foreign measures, made to order. See page 120.

For Nos. 1675 etc., see page 136.

PATENT SCALE GUARDS.



No. N1691.

N1691. Patent Guards for Triangular Scales, nickel silver . . . each $

For Sheaths for Scales, see page 133.

PAPER SCALES.

PRINTED ON BRISTOL BOARD FROM ENGINE DIVIDED PLATES.

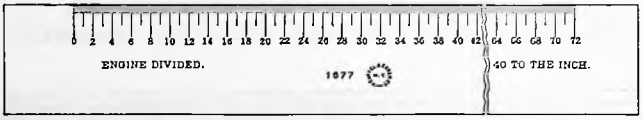
19 × 13¼ inches.

(Each scale has only one division, except Nos. 1678, 1689.)



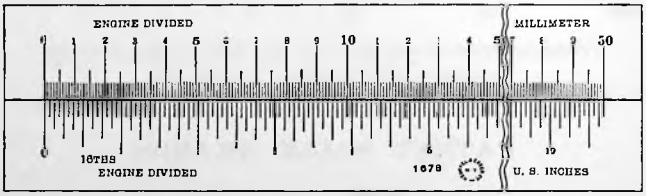
1675. Set A, 6 in Set, div. ¼, ½, ¾, 1, 1½, 3 in. to the foot, set $

1676. do. B, 6 " " " 3/32, ⅛, 3/16, ¼, 3/8, ½ " " " " " "
Separate Scales, any of the above . . . . . each



1677. Set C, 6 in Set, div. 10, 20, 30, 40, 50, 60 parts to the in., set $
Separate Scales, any of the above . . . . . each

1677 T. Separate Scales, div. 2 in., 4 in. to the foot,
66 parts per inch, inches in 16ths. . . . "



No. 1678.

1678. Metric and Inch Comparing Scale, ½ meter long, divided 16ths inches and millimeters . . . . . each $

1679. Metric Scale, ½ meter long, div. millimeters . . . . . "

1689. Scale of Proportional Inches, 12 in., div. ⅛, ¼, ½, 1 inches, with chart showing the formation of the most useful alphabets used for lettering purposes. . . . . "

MAP MEASURES.

(CHARTOMETERS.)



No. 1692.

1692. Map Measure, 5 in., swiveling metal handle with lock nut, dial about $1\frac{1}{2}$ in , with 2 graduations; inches : miles, and centimeters : kilometers . . . . . each $



No. 1694 B.



1694 A.



1695.

1694 A. Map Measure, watch pattern, nickelplated, $1\frac{3}{8}$ in. diam., registers 25 feet in feet, inches and eighths inches . . . . . each

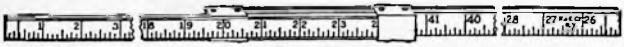
1694 B. Map Measure, like No. 1694 A, but $1\frac{1}{2}$ in. diam. . . . . "

1695. Map Measure, watch pattern, nickelplated, $1\frac{3}{4}$ in. diam., three numbered dials, registers 100 feet in feet, inches and eighths inches, with device for setting back to zero; with directions . . . . . "

To measure a line, the instrument is set to zero, and the wheel is run over the map, (the instrument being held perpendicularly) following closely the line or distance to be measured. The index hands on the dial will then indicate the length of the line in feet, inches and eighths inches.

EXTENSION MEASURES.

Door and window frames, heights of ceilings, etc., can be measured readily and accurately with these useful rules. They can be quickly extended within a window or other opening to the exact distance between any two points, and can be CLAMPED so that they will maintain the length to which they have been extended. The extension rule can be used between points not accessible for measuring with a tape.



No. 1699.

1699 A.	Extension Measure,	2	feet,	2	fold	extending to	4	feet,	each	$
1699 B.	do.	3	"	2	"	"	6	"	"	
1699 C.	do.	4	"	2	"	"	8	"	"	
1699 D.	do.	5	"	2	"	"	10	"	"	

Extension Measures No. 1699 A to D are of hardwood with brass trimmings. Readings are taken opposite the end of the first section for all measurements beyond the first section. They are graduated in feet, inches and eighths of inches, and are provided with a clamping device.

SHRINKAGE RULES.

ENGINE DIVIDED.



No. 1701.

These Shrinkage Rules are of hardwood, brass tipped, both sides divided, about 1⅛ in. wide by ⅛ in. thick and divided into eights, tenths, twelfths and sixteenths inches. They are superior to all others in quality, accuracy and finish.

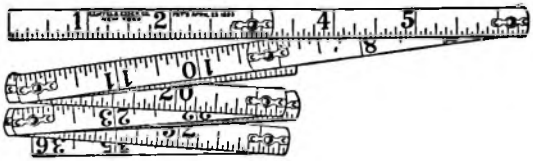
1700.	Shrinkage Rule,	$24\frac{2}{10}$	= 24 in.	(1 foot	= 12.1 in.)	each	$
1701.	do.	$24\frac{1}{8}$	= 24 "	(1 "	= $12\frac{1}{8}$ in.)	"	
1701½.	do.	$24\frac{3}{8}$	= 24 "	(1 "	= $12\frac{3}{10}$ in.)	"	
1702.	do.	$24\frac{1}{2}$	= 24 "	(1 "	= $12\frac{1}{4}$ in.)	"	
1702½.	do.	$24\frac{5}{8}$	= 24 "	(1 "	= $12\frac{5}{16}$ in.)	"	
1704.	do.	$25\frac{1}{2}$	= 24 "	(1 "	= $12\frac{3}{4}$ in.)	"	
1705.	do.	26	= 24 "	(1 "	= 13 in.)	"	

1701 for Cast iron. 1701½ Brass and Aluminum. 1702 Steel.
1702½ Zinc and Lead.

Rules for any other shrinkage made to order. Prices on application.

K & E FOLDING STEEL POCKET RULES.

SPRING JOINTS.



No. 1727.

These Rules are made of carefully tempered spring steel, ⅜ in. wide and graduated on both sides. They fold up smaller than any other rule; the 12-fold three-foot rule is only ⅓ in. thick X 3¾ in. long when folded.

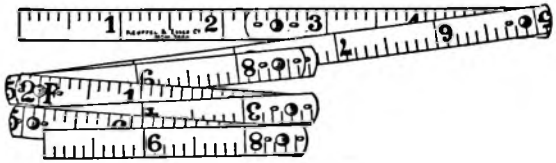
The divisions are sharp and accurate and the numbering is very distinct. It runs in opposite directions on the two sides. The aligning springs at the joints hold the rule in a rigid straight line when it is opened, without in any way interfering with folding it.

Divided $\frac{1}{16} \times \frac{1}{16}$ In.

1725. K & E Steel Pocket Rule, 1 foot, 4 fold, div. $\frac{1}{16} \times \frac{1}{16}$ in., . each $

1726. " " " " 2 " 8 " " do. " "

1727. " " " " 3 " 12 " " do. " "



No. 1727 D. (100ths-foot side.)

Divided: $\frac{1}{16}$ in. $\times \frac{1}{100}$ ft.

1725 D. K & E Steel Pocket Rule 1 foot, 4 fold, $\frac{1}{16}$ in. $\times \frac{1}{100}$ ft. . each $

1726 D. " " 2 " 8 " do. do. " "

1727 D. " " 3 " 12 " do. do. " "

As the rules 1725 D to 1727 D have one side divided to 10ths and 100ths of a foot, they are useful to the Civil Engineer in connection with measuring with tapes or band chains. The numbering on these rules begins at the same end on both sides.

Divided: $\frac{1}{16}$ in. × mm.

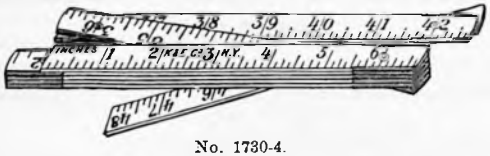
1728. K & E Steel Pocket Rule, metric, 3 foot 12 fold . . . . . each $

Leather Sheaths for 1 and 2 foot rules . . . . . "

" " " 3 foot rules . . . . . "

K & E FOLDING POCKET RULES.

SPRING JOINTS, HARDWOOD, YELLOW FINISH; 5/8 in. WIDE.



No. 1730-4.

1730-2.	K & E Pocket Rule,	2	feet.	4	fold,	div. $\frac{1}{16}\times\frac{1}{16}$ in.,	metal tips	doz.	$
1730-3.	do.	do.	3	"	6	"	"	do.	"	"	"	"
1730-4.	do	do.	4	"	8	"	"	do.	"	"	"	"
1730-5.	do.	do.	5	"	10	"	"	do.	"	"	"	"
1730-6.	do.	do.	6	"	12	"	"	do.	"	"	"	"
1730-8.	do.	do.	8	"	16	"	"	do.	"	"	"	"
1730-5F.	K & E Pocket Rule,	numbered feet and inches, 5 feet, 10 fold, div. $\frac{1}{16}\times\frac{1}{16}$ in.,										
1730-6F.	do.	do.	6	"	12	"	"	do.	"	"	"	"
1730-4D.	K & E Pocket Rule,	4 feet, 8 fold, div. $\frac{1}{16}$ in. $\times\frac{1}{100}$ ft.,										
1730-6D.	do.	do.	6	"	12	"	"	do.	"	"	"	"
1732-4M.	do. metric	do.	4	"	8	"	"	$\frac{1}{16}$ in. $\times$ mm.			"	"

Nos. 1730-2 to 1732-4 M are provided with ingenious spring joints, which hold the rule in a straight line when open, so that vertical or horizontal distances may be easily measured. The ends are provided with metal tips, to protect them against wear.

SPRING JOINTS, HARDWOOD, YELLOW FINISH; 3/8 IN. WIDE.

NARROW.



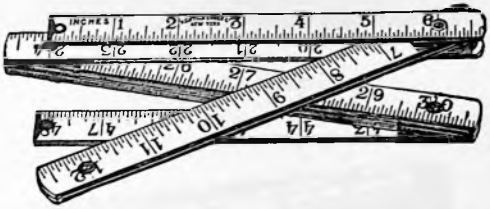
No. 1736-3.

1736-3. K & E Pocket Rule, 3 feet, 9 fold, div. $\frac{1}{16}\times\frac{1}{16}$ in, metal tips, each $

No. 1736-3 is made like numbers 1730-2 etc., but is in 4-inch joints and only 3/8 in wide. The 3 foot rule, when closed, measures only 3/8 x 5/8 x 5 inches. This miniature rule is therefore very convenient for the pocket. It is just as accurate as the larger rules.

K & E FOLDING POCKET RULES.

SPRING JOINTS, HARDWOOD, WHITE FINISH; 5/8 IN. WIDE.



No. 1740–4.

1740-2 to 1742-4-M. K & E Folding Pocket Rules have a white finish on which the black graduations and figures are much more distinct and legible than on the yellow rules.

1740-2.	White Pocket Rule, 2 ft., 4 fold, div. $\frac{1}{16} \times \frac{1}{16}$ in., **metal tips,** each												$
1740-3.	do.	do.	do.	3	"	6	"	"	do.	"	"	"	"
1740-4.	do.	do.	do.	4	"	8	"	"	do.	"	"	"	"
1740-5.	do.	do.	do	5	"	10	"	"	do.	"	"	"	"
1740-6.	do.	do.	do.	6	"	12	"	"	do.	"	"	"	"
1740-8.	do.	do.	do.	8	"	16	"	"	do.	"	"	"	"
1740-4-D.	do.	do.	do.	4	"	8	"	"	$\frac{1}{16}$ in. $\times \frac{1}{100}$ ft.			"	"
1740-6-D.	do.	do.	do.	6	"	12	"	"	do.	do.		"	"
1742-4-M.	do.	do.	**metric,**	4	"	8	"	"	$\frac{1}{16}$ in. $\times$ mm.			"	"

K & E FOLDING RULES.

NARROW.

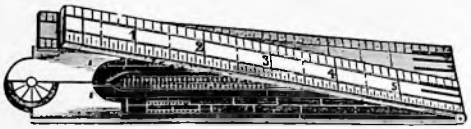


No. 1746-3.

1746-3. Ivorine Pocket Rule, 3 ft., 9 fold, div. $\frac{1}{16}\times\frac{1}{16}$ in., metal tips, each $

SCALE RULES.

No 1720.



1720. Ivory Joint Rule, 2 feet, 4 fold nickel silver mounted, 24 in. to $\frac{1}{8}$, first 6 in. to $\frac{1}{16}$, 12 in. to $\frac{1}{6}$, 12 in. to $\frac{1}{12}$, edge divided: foot to $\frac{1}{100}$. The inside edges are beveled and have Scales of $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 in. to the foot; inside faces have Scales (not brought to edge) of $\frac{1}{8}$, $\frac{7}{8}$, $1\frac{1}{4}$, $1\frac{1}{2}$ in. to the foot. The main joint is graduated to 5 degrees, for setting off angles . . . . . each $

1721. Boxwood Joint Rule, 2 feet, 4 fold, nickel silver mounted, 24 in. to $\frac{1}{8}$, first 5 into $\frac{1}{12}$, 12 in. to $\frac{1}{10}$, 12 in. to $\frac{1}{12}$, edge divided: foot to $\frac{1}{100}$. The inside edges are beveled and have Scales of $\frac{1}{12}$, $\frac{1}{10}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 in. to the foot; inside faces have Scales (not brought to the edge) of $\frac{1}{8}$, $\frac{1}{3}$, $\frac{5}{8}$, $\frac{7}{8}$, $1\frac{1}{4}$, $1\frac{1}{2}$, 2, 3 in. to the foot. The main joint is graduated to 5 degrees, for setting off angles . . . . . "

1722. Boxwood Joint Rule, 2 feet 4 fold, Brass mounted, 24 in., graduated to $\frac{1}{8}$, 12 in. to $\frac{1}{12}$, 12 in. to $\frac{1}{10}$, 24 in. to $\frac{1}{16}$. Scales on beveled edges of $\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 in. to the foot. The main joint is graduated at 45, 60 and 90 degrees. . . . . "

ROLLING PARALLEL RULES.

FINEST QUALITY.

Our Metal Rolling Parallel Rules are constructed to insure the greatest possible accuracy of motion and are also much heavier than those generally offered. The metal guard over the axle is so shaped that it forms a convenient handle.



No. 1751.

NICKEL SILVER.

1751.	Parallel Rule,	12 in.,	weight about 32 oz.;	in plain Box . each $
1753.	do.	18 "	" " 54 "	" " " . "
1754.	do.	24 "	" " 72 "	" " " . "
1754 H.	do.	24 "	" " 10 lb. "	" " " . "

Parallel Rule No. 1754H is extra heavy (about ¾ in. thick) and is recommended as the most reliable parallel rule for the most accurate work.

BRASS.

1756.	Parallel Rule,	12 in.,	weight about 32 oz.;	in plain Box . each $
1758.	do.	18 "	" " 54 "	" " " . "
1759.	do.	24 "	" " 72 "	" " " . "

Mahogany Boxes for Nos. 1751 to 1759 12 18 24 in.
each $



No. 1882.

MAPLE, XYLONITE LINED.

(Transparent Edges.) each

1882.	Xylonite Lined Rolling Parallel Rule,	Nickelplated Mountings,	12 in. $
1884.	do.	do.	do.	do.	"	"	18 "

These Parallel Rules are substantially made and very accurate. The metal guard over the axle materially adds to their weight. The blade is of maple with beveled transparent Xylonite edges.

FOLDING PARALLEL RULES.



No. 1782.

Folding Parallel Rules, Ebonized Hardwood, Nickelplated Brass Bars,

	1780	1782	1783	1784	1785
	6	12	15	18	24 in.
each	$				

SIGSBEE'S PATENT PARALLEL RULES.

U. S. Navy Pattern.



No. 1796.

1796. Sigsbee's Patent Parallel Rules, Ebony, 15 in., ... each $

1797. " " " " " 18 " . . . . . "

1798. " " " " " 24 " . . . . . "

These Parallel Rules have nickelplated brass mountings and the bars are pivoted, so that the rule can be laid over, (stepping) to cover any distance.

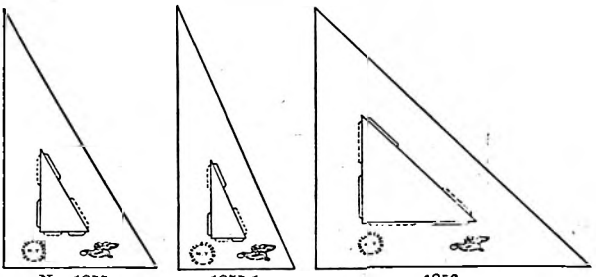
EBONY.

On account of the extreme scarcity of real Ebony, the trades using this material have been forced to substitute stained wood of various kinds, while they have retained the designation Ebony.

We have followed this custom in describing our goods, although we furnish **BLACK BOXWOOD** where we designate Ebony. We have adopted black **BOXWOOD** because it is even superior to Ebony in hardness, smoothness and color.

XYLONITE (TRANSPARENT) TRIANGLES.

The Xylonite which we use in manufacturing our goods, is made specially for such tools, and stands up better than the material generally employed for the purpose.

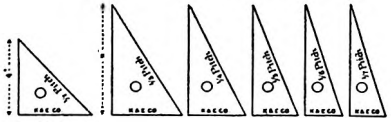


No. 1855. 1855-1. 1856.

1855. Improved Xylonite Triangles (transparent), 30 × 60 degrees,
4 6 7 8 9 10 12 14 16 18 in
each $

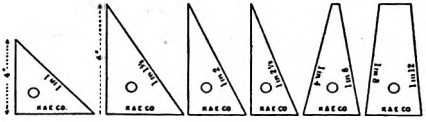
1855-1. Improved Xylonite Triangles (transparent), 22½ × 67½ degrees,
4 6 8 10 12 in.
each $

1856. Improved Xylonite Triangles (transparent), 45 degrees,
4 6 7 8 9 10 12 14 16 18 in.
each $



No. 1857 A.

1857A. Xylonite Triangles for roof pitches, 6 in set . . . . . set $



No. 1857 B.

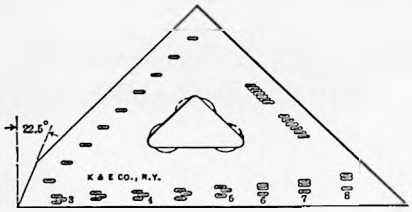
1857B. Xylonite Triangles for embankments, 8 slopes on 6 templets, set $



No. 1858.

1858. Xylonite Lettering Templets, 8 in set . . . . . set $

LETTERING TRIANGLE.

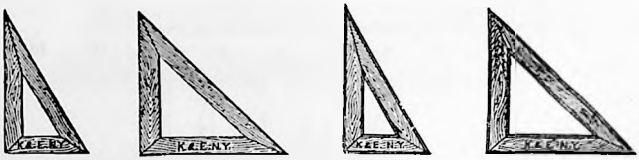


No. N 1859.

N1859. Xylonite Lettering Triangle, 6 in. . . . . each $

Xylonite Lettering Triangle, No. N 1859 has the form of a 6 inch, 45 degree triangle, with one 45 degree corner cut off to form an angle of 67½ degrees. It has a number of oblong, beveled slots, permitting the insertion of a chisel-pointed pencil for the purpose of drawing horizontal guide lines to facilitate lettering. Directions furnished with each Lettering Triangle.

WOODEN TRIANGLES.



No. 2110. 2121. 2130. 2141.

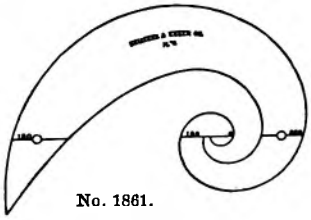
Wooden Triangles, framed, 30 × 60 degrees, No. 2110 (7) 2111 (9) 2112 (11) 2113 (14 in.)
each $

Wooden Triangles, framed, 45 degrees, No. 2120 (6) 2121 (8) 2122 (10) 2123 (12 in.)
each $

Hardwood lined Triangles, 30 × 60 degrees,
No. 2130 (7) 2131 (9) 2132 (11) 2133 (14 in.)
each $

Hardwood lined Triangles, 45 degrees,
No. 2140 (6) 2141 (8) 2142 (10) 2143 (12 in.)
each $

LOGARITHMIC SPIRAL CURVE. (Transparent.)



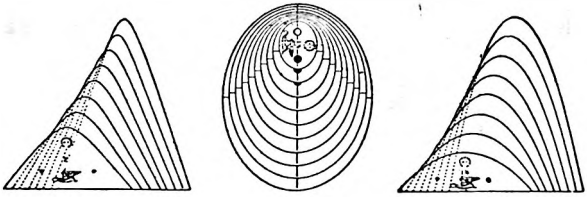
No. 1861.

1861. Logarithmic Spiral Curve, Xylonite, 8 in., with Directions . . . . . each $

This curve is constructed on mathematical principles and contains every curve within the limit of its size. It is a tool of large scope and useful also for various calculations. Full Directions are furnished with it.

Book 117. The Logarithmic Spiral Curve. By Wm. Cox. This pamphlet (10 pages) explains the origin of logarithms, describes the method of constructing this curve and illustrates its use by means of several practical examples.

ELLIPSES, HYPERBOLAS, PARABOLAS.



No. 1862B. 1862. 1862C.

XYLONITE (Transparent)

1862. Xylonite Ellipses, set of 10, major axis, 1½ to 6 in. (by ½ in.) set $

1862A. do. do. " 6, " " 2 " 4½ " " ½ " "

The ratio of the axes of ellipses is 3 : 4. Both axes are marked.

1862B. Xylonite Hyperbolas, set of 8, height 2 to 5½ in. (by ½ in.) "

1862C. do. Parabolas " 8, " 1½ " 5⅝ " " ⅝ " "

1862D. do. do. " 8, " 3½ " 14 " " 1½ " "

IRREGULAR (FRENCH) CURVES.

Xylonite (transparent).

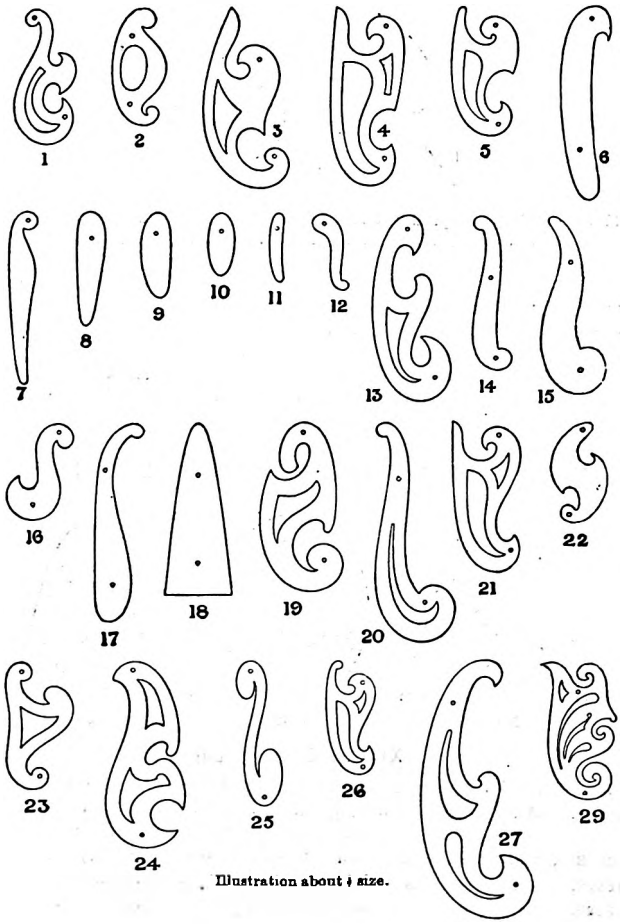


Illustration about ⅓ size.

IRREGULAR CURVES.

1860. Xylonite (Transparent) Irregular Curves.

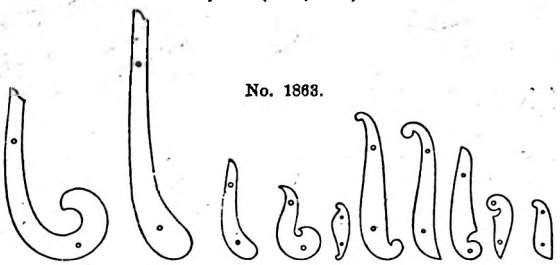
Pattern No.		Pattern No.		Pattern No.	
1	each $	11	each $	21	each $
2	"	12	"	22	"
3	"	13	"	23	"
4	"	14	"	24	"
5	"	15	"	25	"
6	"	16	"	26	"
7	"	17	"	27	"
8	"	18	"	29	"
9	"	19	"		
10	"	20	"		

In ordering, please state catalogue and pattern number.

CURVES FOR MECHANICAL ENGINEERS, IN SETS

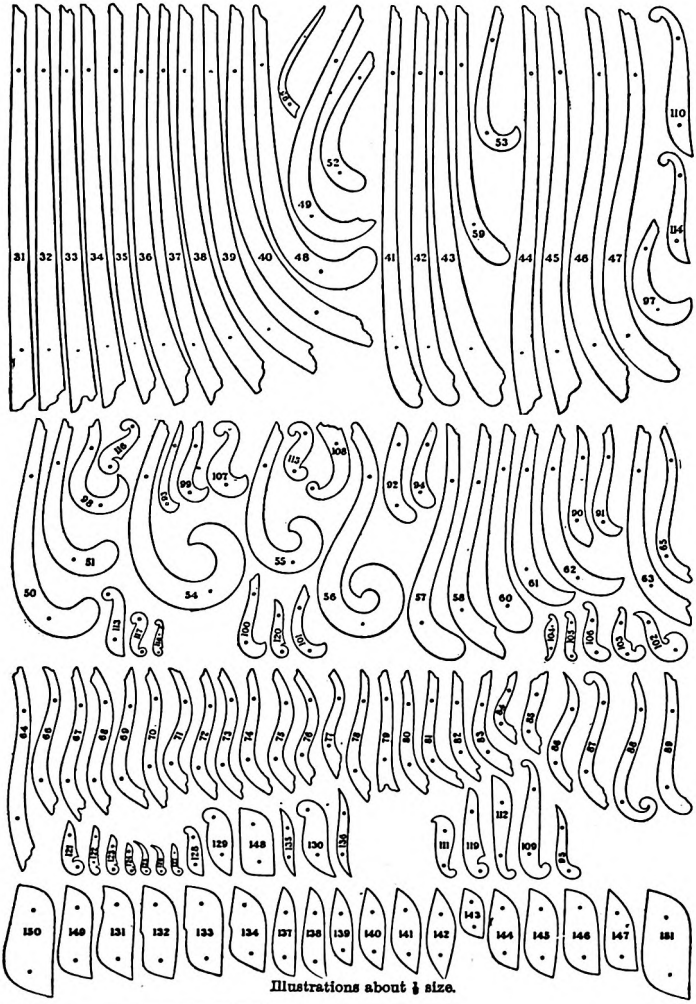
Xylonite (transparent).

No. 1863.



1863. Set of 10 Xylonite Curves (transparent), for Mechanical Engineers, containing: Nos. 55, 60, 94, 102, 104, 109, 114, 119, 121, 128 of No. 1864, (page 151); in wooden box, set . . . $

SHIP CURVES (Copenhagen). Xylonite (transparent)



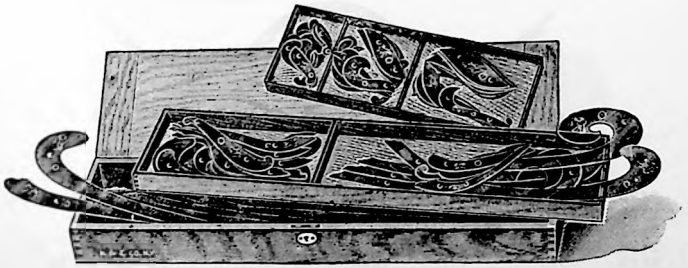
Illustrations about ½ size.

COPENHAGEN SHIP CURVES

No. 1864. Xylonite (transparent)

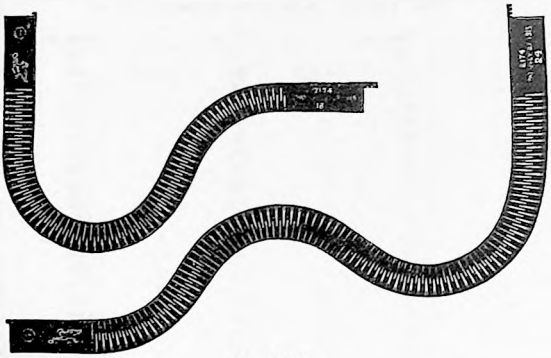
Pattern No.		Pattern No.		Pattern No.		Pattern No.	
31	each $	62	each $	92	each $	122	each $
32	"	63	"	93	"	123	"
33	"	64	"	94	"	124	"
34	"	65	"	95	"	125	"
35	"	66	"	96	"	126	"
36	"	67	"	97	"	127	"
37	"	68	"	98	"	128	"
38	"	69	"	99	"	129	"
39	"	70	"	100	"	130	"
40	"	71	"	101	"	131	"
41	"	72	"	102	"	132	"
42	"	73	"	103	"	133	"
43	"	74	"	104	"	134	"
44	"	75	"	105	"	135	"
45	"	76	"	106	"	136	"
46	"	77	"	107	"	137	"
47	"	78	"	108	"	138	"
48	"	79	"	109	"	139	"
49	"	80	"	110	"	140	"
50	"	81	"	111	"	141	"
51	"	82	"	112	"	142	"
52	"	83	"	113	"	143	"
53	"	84	"	114	"	144	"
54	"	85	"	115	"	145	"
55	"	86	"	116	"	146	"
56	"	87	"	117	"	147	"
57	"	88	"	118	"	148	"
58	"	89	"	119	"	149	"
59	"	90	"	120	"	150	"
60	"	91	"	121	"	151	"
61	"						

In ordering, please state catalogue and pattern number.



1865 S. Set of 121 **Xylonite** (transparent) Copenhagen Ship Curves, Nos. 31 to 151, as listed above under No. 1864; in hardwood Case . . . . . each $

ADJUSTABLE CURVE RULES.

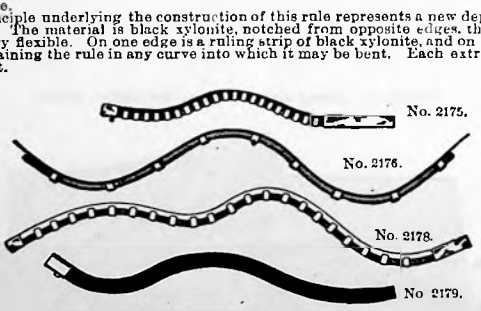


No. 2174.

2174. Flexible Curve Rule, (Patented). 12 18 24 30 in. long.
each $

This new flexible curve rule embodies all the advantages, without any of the drawbacks, of the ordinary curve rules, which for certain classes of work are often too thick and clumsy. It will also be found preferable to splines, as the latter require heavy weights to keep them in place.

The principle underlying the construction of this rule represents a new departure for curve rules. The material is black xylonite, notched from opposite edges, thus making the rule very flexible. On one edge is a ruling strip of black xylonite, and on the other a wire for retaining the rule in any curve into which it may be bent. Each extremity ends in a tangent.



2175.	Adjustable Curve Rule,		14½ in. long	each $
2176.	do.	do.	30 " "	"
2177.	do.	do.	cheaper construction, 12 in. long	"
2178.	do.	do.	" " 24 " "	"
2179.	do.	do.	plain 7 15	31 in.

each $

These patent curve rules consist of a ruling edge of rubber (except No. 2176, which has steel ruling edge) in combination with a bar of soft lead. They will hold any curve into which they are bent.

SPLINES AND SPLINE WEIGHTS.



Section of 2185. No. 2185 with 2186 or 2186-1.

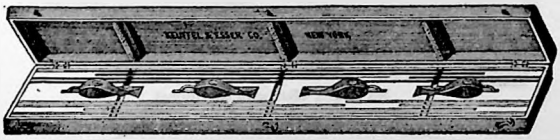
1859 B. Black Xylonite Splines, grooved,
24 30 36 42 48 in.
each $

2185. Wood Splines, grooved,
36 48 60 in.
each $

These Splines are grooved as shown in the section, to admit the finger of the weights which hold them in position.

2186. Lead Weights for Splines, with finger, about 3¾ pounds . . each $

2186-1. Lead do. " do. " " " 8 " . . "



No. 2190.

2190. Set of Splines and Spline Weights; in strong wooden Box, cont'g:

4 Spline Weights, No. 2186,

1 each Xylonite Splines, No. 1859B, 24, 30, 36, 42, 48 in.

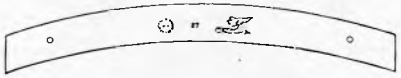
1 " Wood " " 2185, 36, 48, 60 " set $

RAILROAD CURVES.

These curves are cut by special machinery and are true circular curves. They are the same on both edges, so that either edge can be used. Our curves will be found far more accurate than any others. Their edges have the same hand finish (not polish) as our other xylonite tools.

They are put up in wooden boxes, with partitions (except No. 1891) to prevent warping of the curves from mutual pressure while in the box. Each compartment is plainly stamped with the value of the curves contained in it, so that the required curve is easily picked out.

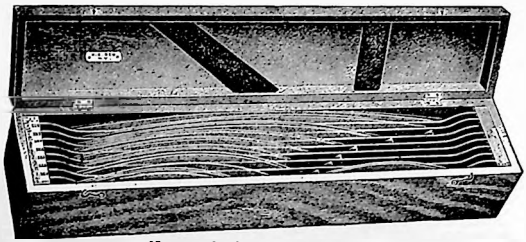
XYLONITE RAILROAD CURVES.



1891. Xylonite (transparent) Railroad Curves, 17 in set, viz: 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57, 60 in. radius; in wooden box. . . . . set $

1891 A. Xylonite (transparent) Railroad Curves, 30 in set, viz: 1½, 2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, 7, 8, 9, 10, 11, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 35, 40, 45, 50, 60 in. radius; in wooden box with partitions . . . . . "

1891 B. Xylonite (transparent) Railroad Curves, 50 in set, viz.: 1½, 2, 2½, 3, 3½ 4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 8½, 9, 9½, 10, 10½, 11, 11½, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120 in. radius; in wooden box with partitions . "



No. 1891 C. (Box with partitions)



1891 C. Xylonite (transparent) Railroad Curves, with Tangent, 55 in set, viz. : 3, 3½, 4, 4½, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 22, 23, 24, 25, 26, 27, 28, 30, 32, 34, 35, 36, 38, 40, 45, 50, 55, 60, 65, 70, 75, 80, 90, 100, 110 120, 130, 140, 150, 160, 170, 180, 190, 200 in radius; in wooden box with partitions. set $



1891 D. Xylonite (transparent) Railroad Curves, with Tangent, marked in degrees and inches, to scale 100 feet = 1 inch, 41 in set, viz.:

0°.30′ = 114.59 in.	3°.30′ = 16.37 in.	6° = 9.55 in.	8°.30′ = 6.75 in.
1°. = 57.30 "	3°.45′ = 15.28 "	6°.15′ = 9.17 "	8°.45′ = 6.55 "
1°.15′ = 45.84 "	4° = 14.33 "	6°.30′ = 8.82 "	9° = 6.37 "
1°.30′ = 38.20 "	4°.15′ = 13.48 "	6°.45′ = 8.49 "	9°.15′ = 6.20 "
1°.45′ = 32.74 "	4°.30′ = 12.73 "	7°. = 8.19 "	9°.30′ = 6.04 "
2° = 28.65 "	4°.45′ = 12.07 "	7°.15′ = 7.91 "	9°.45′ = 5.88 "
2°.15′ = 25.47 "	5° = 11.46 "	7°.30′ = 7.64 "	10° = 5.74 "
2°.30′ = 22.92 "	5°.15′ = 10.92 "	7°.45′ = 7.40 "	10°.30′ = 5.46 "
2°.45′ = 20.84 "	5°.30′ = 10.42 "	8° = 7.17 "	11° = 5.22 "
3° = 19.10 "	5°.45′ = 9.97 "	8°.15′ = 6.95 "	11°.30′ = 4.99 "
3°.15′ = 17.63 "	in wooden box with partitions.		set $

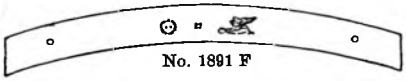
1891 E. Xylonite Railroad Curves, with Tangent, marked in degrees and inches, to scale 100 feet = 1 inch, 55 in set, viz.:

0°.15′ = 229.18 in.	3°.45′ = 15.28 in.	7°.15′ = 7.91 in.	11°.30′ = 4.99 in.
0°.30′ = 114.59 "	4° = 14.33 "	7°.30′ = 7.64 "	12°. = 4.78 "
0°.45′ = 76.39 "	4°.15′ = 13.48 "	7°.45′ = 7.40 "	12°.30′ = 4.59 "
1°. = 57.30 "	4°.30′ = 12.73 "	8° = 7.17 "	13° = 4.42 "
1°.15′ = 45.84 "	4°.45′ = 12.07 "	8°.15′ = 6.95 "	13°.30′ = 4.25 "
1°.30′ = 38.20 "	5° = 11.46 "	8°.30′ = 6.75 "	14° = 4.10 "
1°.45′ = 32.74 "	5°.15′ = 10.92 "	8°.45′ = 6.55 "	14°.30′ = 3.96 "
2°. = 28.65 "	5°.30′ = 10.42 "	9° = 6.37 "	15° = 3.83 "
2°.15′ = 25.47 "	5°.45′ = 9.97 "	9°.15′ = 6.20 "	16° = 3.59 "
2°.30′ = 22.92 "	6° = 9.55 "	9°.30′ = 6.04 "	17° = 3.38 "
2°.45′ = 20.84 "	6°.15′ = 9.17 "	9°.45′ = 5.88 "	18° = 3.20 "
3°. = 19.10 "	6°.30′ = 8.82 "	10°. = 5.74 "	19° = 3.03 "
3°.15′ = 17.63 "	6°.45′ = 8.49 "	10°.30′ = 5.46 "	20° = 2.88 "
3°.30′ = 16.37 "	7° = 8.19 "	11° = 5.22 "	

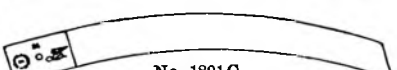
in wooden box with partitions. (see cut, page 154) set $

These Xylonite Railroad Curves are made to correct radii, to a scale of 1 inch = 100 feet, both edges having the same radius. Formula: radius = ½ chord ÷ sin. ½ angle = 50 ÷ sin. ½ angle. The short tangents are very useful, as they enable the beginning of the curve to be correctly located on the drawing by means of the radial line separating the tangent from the curve. These curves can also be used for the formula ½ arc ÷ sin ½ angle, the difference being negligible.

SEPARATE RAILROAD CURVES.



No. 1891 F



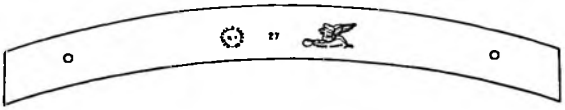
No. 1891 G.

Railroad Curves, as described above, cut to order to any desired scale or radius.

1891 F. Separate (transparent) Xylonite Railroad Curves. . . . . each $

1891 G. do. do. do. do. with 3 in. Tangent "

WOODEN RAILROAD CURVES.

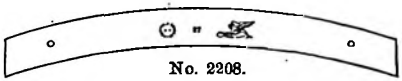


2200. Wooden Railroad Curves, 10 in set, viz.: 12, 24, 36, 48, 60, 72, 84, 96, 108, 120 in. radius; in wooden Box . . . . . set $

2202. Wooden Railroad Curves, 17 in set, viz.: 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57, 60 in. radius; in wooden Box . . . . . "

2204. Wooden Railroad Curves, 44 in set, viz.: 3, 3½, 4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 8½, 9, 9½, 10, 12, 14, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 42, 48, 54, 60, 66, 72, 78, 84, 90, 100, 110, 120, 130, 140, 160, 180, 200 in. radius; in wooden Box . . . . "

SEPARATE RAILROAD CURVES.



No. 2208.

Railroad Curves, as described above, cut to order to any desired radius.

2208. Separate Wooden Railroad Curves . . . . . each $

CARDBOARD RAILROAD CURVES.

2210. Cardboard Railroad Curves, 80 in set, viz.: 1½, 2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, 7, 8, 9, 10, 11, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 35, 40, 45, 50, 60 in. radius; in wooden Box . set $

2211. Cardboard Railroad Curves, 50 in set, viz.: 1½, 2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 8½, 9, 9½, 10, 10½, 11, 11½, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120 in. radius; in wooden Box . . . . . "

STRAIGHTEDGES.



No. 1886.

1886. Xylonite Lined Straightedges, Maple, square edges,

18 24 30 36 42 48 54 60 in.

each $



No. 2250.

2250. Hardwood Straightedges, thick, one edge beveled,

12 15 18 24 30 36 42 in.

each $



No. 2260.

2260. Hardwood lined Straightedges, thin, square edges,

48 54 60 72 84 96 120 in.

each $



No. 2270.

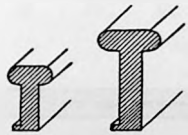
2270. Mahogany Straightedges, Ebony lined, thin, square edges,

24 30 36 42 48 54 in.

each $

For Metal Straightedges, see page 163.

BARS FOR BEAM COMPASSES.



No. 2280. ½ in. thick. 2282. ¼ in. thick.

2280. Hardwood Bars for Beam Compasses No. 509.

24 30 36 42 48 60 in.

each $

2282. Hardwood Bars for Beam Compasses Nos. 510 and 772,

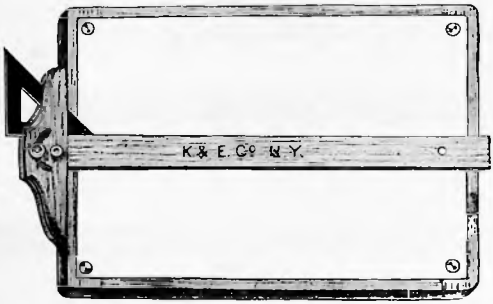
24 30 36 42 48 60 in.

each $

In ordering these bars, please state catalogue number of beam compasses.

WOODEN T SQUARES.

K. & E. CO. PATTERN.



We call attention to the K. & E. Co. pattern of double-head (shifting) T Squares. These T Squares have two swivels, of which the smaller serves as pivot on which the head shifts, while the larger, placed near the end of the blade for better leverage, and passing through an arched recess in the upper head, clamps the shifting head rigidly. The two heads of these T Squares are separated to the extent of the thickness of the blade, and either head is made to lie flush with the drawing board so that a triangle can be applied up to the edge of the board by passing it between the two heads of the T Square. A glance at the illustration will show the great superiority of these T Squares over all others.



No. 2300.

2300. Wooden Blade and fixed Head,

15 18 21 24 30 36 42 48 54 60 72 in.

each $

WOODEN T SQUARES.

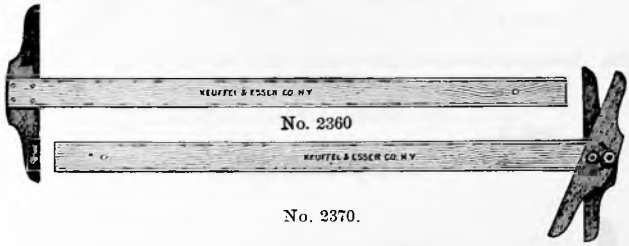


No. 2330.

2330. Maple Blade, Black Walnut fixed Head,

24 30 36 42 in.

each $



No. 2360

No. 2370.

2360. Hardwood lined Blade, Black Walnut fixed Head,

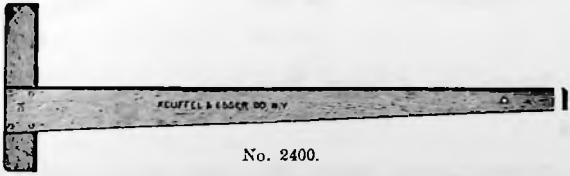
24 30 36 42 48 54 60 72 in.

each $

2370. Hardwood lined Blade, Black Walnut shifting double Head, K. & E. Co. pattern, with two fine, brass milled-head swivels,

24 30 36 42 48 54 60 72 in.

each $



No. 2400.

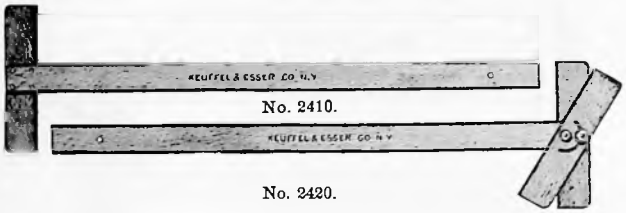
2400. Mahogany Head and Blade, Ebony lined, beveled edge, fixed Head.

The blade of No. 2400 is tapered and very wide at the base, to prevent spring at the further (free) end. The drawing edge is in line with the middle of the head.

36 42 48 54 in.

each $

WOODEN T SQUARES.



No. 2410.

No. 2420.

2410. Mahogany Head and Blade, Ebony lined, fixed Head,

24 30 36 42 48 54 in.

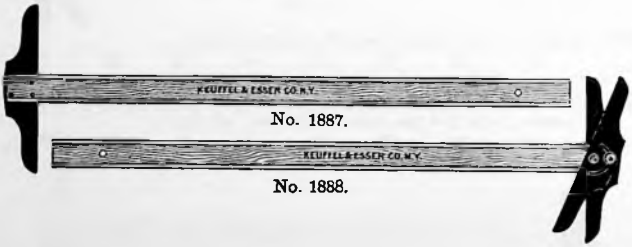
each $

2420. Mahogany Head and Blade, Ebony lined, shifting double Head, K. & E. Co. pattern, with two fine brass milled-head swivels,

30 36 42 48 54 in.

each $

See Note about Ebony, page 144.



No. 1887.

No. 1888.

1887. Xylonite Lined T Squares, Maple blade, ebonized fixed head,

15 18 24 30 36 42 48 54 60 72 in.

each $

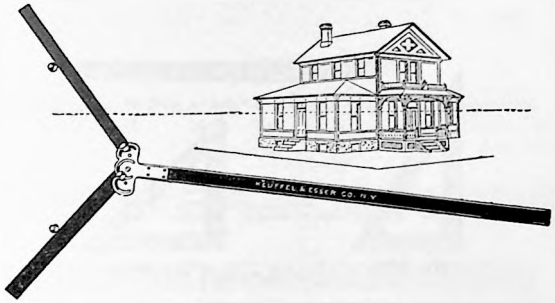
1888. Xylonite Lined T Squares, Maple blade, ebonized shifting head K. & E. Co. pattern, with 2 fine brass swivels. The 15 and 18-in. squares have one swivel.

15 18 24 30 36 42 48 54 60 72 in.

each $

CENTROLINEADS

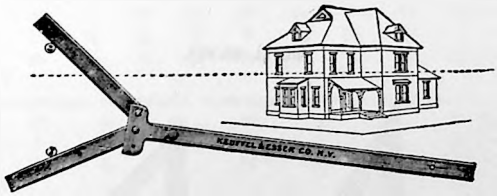
FOR PERSPECTIVE DRAWING



No. N 2450.

N2450. Centrolinead, hardwood, ebonized, brass mountings, Blade 42 in., both edges beveled, Arms 15 in., with two Studs . each $

N 2450 is old No. 2450-2.



No, 2451.

2451. Centrolinead, hardwood, brass swivels, with two Studs, Blade 24 in., Arms 10 in. each $

2453. do. do. do. " 36 " " 12 " "

Centrolineads are used when the vanishing point of a perspective drawing is beyond the drawing board. To use the instrument from the right-hand side one of the blades can be shifted to the socket in the other end of the cross head.

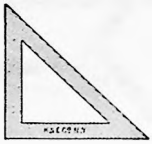
Directions furnished with Centrolineads.

METAL TRIANGLES.

STEEL, NICKELPLATED.



No. 2002.



No. 2003.

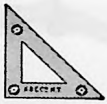
2002. Steel Triangles, **nickelplated,** open center, 30 × 60 degrees,
8 10½ 15 in.
each $

2003. Steel Triangles, **nickelplated,** open center, 45 degrees,
8 10 12 in.
each $

NICKEL SILVER.



No. 2007.



No. 2008.

2007. Nickel Silver Triangles, open center, 30 × 60 degrees,
8 10 12 14 in.
each $

2008. Nickel Silver Triangles, open center, 45 degrees,
8 10 12 in.
each $

Nos. 2007 and 2008 have ivory buttons near the corners, to prevent soiling of the drawing. These buttons are thin and flat, to leave no impression on the paper.

METAL STRAIGHTEDGES.



No. 2018.

2018. Steel Straightedges, flexible, enameled, one side white, other side black.

18	24	30	36	60	72 in. long.
$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2	2 in. wide.

each $

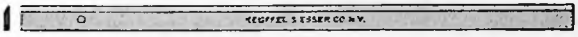
The Flexible Steel Straightedges are of well-tempered spring steel 0.02 in. thick, and are coated with a flexible permanent enamel. They can be coiled up without injury, for carrying in hand baggage. (The 48-in. straightedge weighs but 10 oz.).



No. 2020.



No. 2022.



No. 2030.

2020. Steel Straightedges, nickelplated, with square edges,

15	18	24	30	36	42	48	60	72 in. long
$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3 " wide
$\frac{1}{20}$	$\frac{1}{30}$	$\frac{1}{15}$	$\frac{1}{12}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{15}$	$\frac{1}{12}$	$\frac{1}{10}$ " thick

each $

2022. Steel Straightedges, nickelplated, extra heavy, with square edges,

36	42	48	60	72	84	96 in. long
2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{4}$	$3\frac{1}{2}$ " wide
$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$	$\frac{11}{64}$	$\frac{3}{16}$	$\frac{13}{64}$	$\frac{7}{32}$ " thick

each $

2030. Steel Straightedges, nickelplated, one edge beveled,

15	18	24	30	36	42	48	54	60	72 in. long
$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	$2\frac{3}{4}$	3 " wide
$\frac{1}{24}$	$\frac{1}{24}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{12}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{5}{32}$ " thick

each $

2035. Nickel Silver Straightedges, one edge beveled,

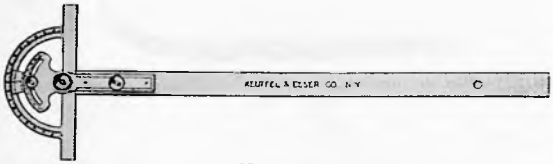
30	36	42	in. long
$1\frac{3}{4}$	2	$2\frac{1}{4}$	" wide
$\frac{1}{10}$	$\frac{1}{8}$	$\frac{1}{8}$	" thick

each $

D. Dividing Metal Straightedges to sixteenths inches . . . per foot $

STEEL T SQUARES.

NICKELPLATED BLADES.



No. 2040.

2040. Protractor T Squares, Steel Blade nickelplated, with nickel silver double Protractor Head, the outside one reading to 1 minute, the inside one to 5 minutes, both with vernier.

24	30	36	in. long
1¼	1½	1½	" wide
1/8	1/8	1/8	" thick

each $

The double protractor makes this T square especially adapted for plotting and of great advantage in mapping mine surveys.



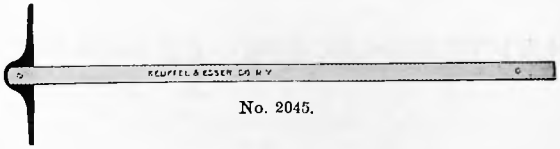
No. 2043.

2043. Protractor T Squares, Steel Blade nickelplated, shifting Bronze Head, with Protractor divided to half degrees, Vernier on end of blade reading to minutes.

24	30	36	42	in. long
1¼	1½	1½	1¾	" wide
1/8	1/8	1/8	1/4	" thick

each $

STEEL T SQUARES.

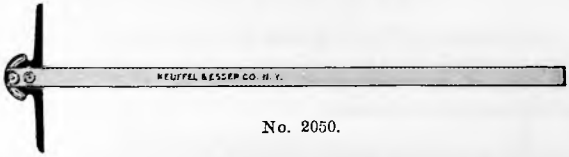


No. 2045.

2045. T Squares, Steel Blade, **nickelplated,** fixed enameled Steel Head,

18	24	30	36	42	in. long
$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	" wide
$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	" thick

each $



No. 2050.

2050. T Squares, Steel Blade, **nickelplated,** shifting enameled Steel Head, with nickelplated swivel,

18	24	30	36	42	in. long
$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	" wide
$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	" thick

each $

ENGRAVER'S T SQUARES.

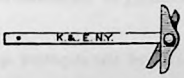


No. 2060.

2060. Engraver's T Squares, Steel Blade, fixed Brass Head,

4	6	8	10	12	in.

each $



No. 2065.

2065. Engraver's T Squares, Steel Blade, shifting Brass Head, with swivel,

4	6	8	10	12	in.

each $

DRAFTING ROOM FURNITURE.

Our catalogue lists all Drafting Room Furniture in one group, thus facilitating the selection of this very important part of the office equipment of the Engineer, Architect and Draftsman.

Our assortment of Modern Drafting Room Furniture comprises the latest and most complete line and the most improved designs in **Blueprinting Apparatus, Drawing Tables, Chests of Drawers, Filing Cabinets,** etc., for the Drafting Room of the professional and of schools.

All these goods are of our own manufacture, and special facilities for making them have been provided in our factory. This is important, as it gives us absolute control of the quality of every component part of our products. Our workmanship is of the highest grade and we guarantee every piece of our Drafting Room Furniture to be exactly as we represent it.

The Hudson Drawing Tables No. 2599, pp. 189 to 191, are designed to meet the demand for a very substantial but inexpensive drawing table. While they are well made and compare very favorably with similar goods of other makes, they do not compare in quality and selection of material with our extra fine office furniture here listed.

It is impossible to **show quality and finish** of such goods by illustration and description, and the buyer who does not want to be disappointed must rely on the reputation and standing of the manufacturer.

We are so well convinced of the superior quality of our Drafting Room Furniture that *we will take back, at our expense, any article which does not prove satisfactory to the buyer upon receipt.*

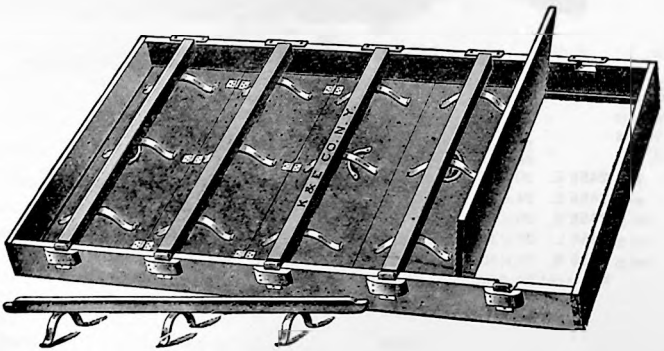
PRINT FRAMES AND BATH TRAYS.

SUPERIOR QUALITY PRINT FRAMES OF SOLID OAK.

These print frames differ greatly from those usually offered. They are made of carefully selected, thoroughly seasoned oak, are of perfect workmanship and have brass trimmings. The springs are as heavy and as numerous as the strength of the glass will allow, to insure perfect contact. The spring catches for the bars are protected by wooden casings, as shown in the cut. The spring bars are metal-tipped at both ends to reduce wear. The frames are made to stand the exposure to the weather incidental to their use. The great advantage of solid oak frames of best quality and workmanship, over the cheaper kind, is their lesser liability to warp and shrink and thereby to break the glass.

For sizes larger than 24 × 30 in. only Plate Glass should be used, on account of its greater strength. It makes better prints and will be found more advantageous also for the smaller sizes.

The Pads listed with the frames are a thick elastic padded cotton fabric. (For Felt Pads, see page 169.)



No. 2455 M.

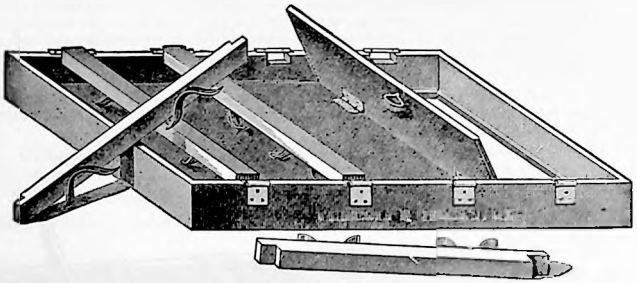
Ship'g weight frames about		Printing Surface		Frame only.
35 lb	2455 E.	20×24	in. . . . each	$
40 lb	2455 G.	24×30	" . . . "	
70 lb	2455 H.	30×42	" . . . "	
85 lb	2455 L.	36×48	" . . . "	
120 lb	2455 M.	36×60	" . . . "	
140 lb	2455 O.	42×60	" . . . "	
170 lb	2455 P.	42×72	" . . . "	

In ordering Print Frames please state whether pad is wanted, and whether double-thick or polished plate glass, or none **See Nos. N 2458 to 2461, page 169.**

The above prices cover crating for shipment.

PRINT FRAMES.

TRADE QUALITY, HARDWOOD.



No. 2456 H.

Ship'g weight frames about		Printing Surface.		Frame only.
35 lb	**2456 E.**	20×24 in.	. . . each	$
40 lb	**2456 G.**	24×30 "	. . . "	
70 lb	**2456 H.**	30×42 "	. . . "	
85 lb	**2456 L.**	36×48 "	. . . "	
120 lb	**2456 M.**	36×60 "	. . . "	

2456 is old No. 2457.

In ordering Print Frames please state whether pad is wanted, and whether double-thick or polished plate glass, or none. See Nos. N 2458 to 2461, page 169.

PRINT FRAMES FOR PATENT OFFICE DRAWINGS, etc.

25 lb	**N2457 A.**	11×16 in., hardwood, each		$
30 lb	**N2457 C.**	16×21 "	"	"

N 2457 is old No. 2458.

In ordering Print Frames please state whether pad is wanted, and whether double-thick or polished plate glass, or none. See Nos. N 2458 to 2461, page 169.

The above prices cover crating for shipment.

POLISHED PLATE GLASS.

			Printing Surface.	Size.		Ship'g weight about
N 2458 E.	Polished plate glass		20×24 in.,	21 ×25 in., . .	each $	39 lb
N 2458 G.	do.	do.	24×30 "	25 ×31 " . .	"	55 lb
N 2458 H.	do.	do.	30×42 "	31 ×43 " . .	"	94 lb
N 2458 L.	do.	do.	36×48 "	37¼×49½ " . .	"	132 lb
N 2458 M.	do.	do.	36×60 "	37¼×61½ " . .	"	154 lb
N 2458 O.	do.	do.	42×60 "	43½×61¼ " . .	"	176 lb
N 2458 P.	do.	do.	42×72 "	43½×73¼ " . .	"	209 lb

Note: N 2458 E-L cut scant $\frac{1}{8}$ in.
N 2458 M-P cut exact.

DOUBLE THICK GLASS.

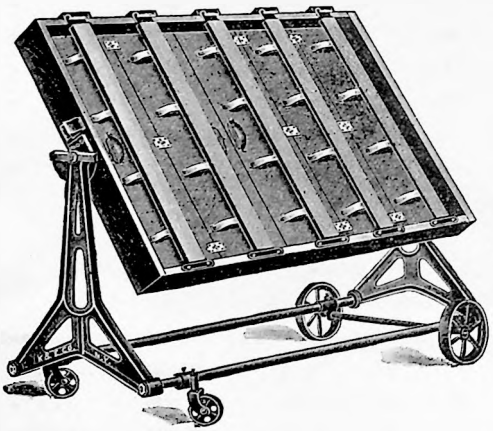
			Printing Surface.	Size.		
2459 A.	Double thick glass		11×16 in.,	11⅛×16⅛ in., ...	each $	10 lb
2459 C.	do.	do.	16×21 "	16⅞×21⅞ "	"	14 lb
2459 E.	do.	do.	20×24 "	21 ×25 "	"	39 lb
2459 G.	do.	do.	24×30 "	25 ×31 "	"	55 lb

Note: 2459 A-C cut exact.
2459 E-G cut scant $\frac{1}{8}$ in.

PADS FOR PRINT FRAMES.

	Padded Cotton.		Felt.	
11×16 in.			2461 A.	each $
16×21 "			2461 C.	"
20×24 "	2460 E.	each $	2461 E.	"
24×30 "	2460 G.	"	2461 G.	"
30×42 "	2460 H.	"	2461 H.	"
36×48 "	2460 L.	"	2461 L.	"
36×60 "	2460 M.	"	2461 M.	"
42×60 "	2460 O.	"	2461 O.	"
42×72 "	2460 P.	"	2461 P.	"

PRINT FRAMES ON WHEEL CARRIAGE.



No. 2462 M.

Shipg weight frame and carriage, about	Carriage with Frame.	Printing Surface.	Without glass and pad.
220 lb	2462 G.	24×30 in., ...	each $
250 lb	2462 H.	30×42 "	"
300 lb	2462 L.	36×48 "	"
350 lb	2462 M.	36×60 "	"
400 lb	2462 O.	42×60 "	"
470 lb	2462 P.	42×72 "	"

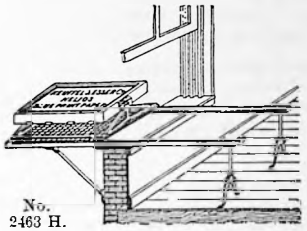
In ordering Print Frames please state whether pad is wanted, and whether double-thick or polished plate glass, or none. See Nos. N 2458 to 2461 page 169.

The above prices cover crating for shipment.

The Carriages are of iron, of most practical and substantial construction. They have one pair of wheels on a common axle and two swiveling wheels. The print frame revolves in the standards and is provided with two spring stops which hold it horizontal and also serve as brakes to hold the frame at any slant during exposure. The Print Frames are our regular solid oak frames, as listed on page 167.

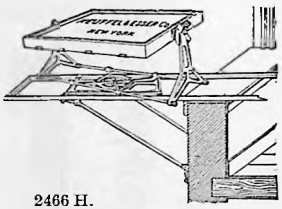
PRINT FRAMES ON CARRIAGE,

ON RAILS, FOR EXPOSING OUTSIDE OF WINDOW.



No. 2463 H.

Frame and Mountings (carriage, rails and supports).



2466 H.

Frame on Revolving Carriage, on rails.

PRINT FRAMES ON TILTING CARRIAGE, OR RAILS.

Frame and Mountings.

	Printing Surface.	Without glass and pad		Ship'g weight frame and mountings, about
2463 H.	30 × 42 in., . . .	each $	In ordering Print Frames please state whether pad is wanted, and whether double-thick or polished plate glass, or none. See Nos. N 2458 to 2461, page 169 for polished plate glass and double thick glass.	200 lb
2463 L.	36 × 48 " . . .	"		270 lb
2463 M.	36 × 60 " . . .	"		340 lb

PRINT FRAMES ON TILTING AND REVOLVING CARRIAGE, ON RAILS.

Frame and Mountings.

	Printing Surface.	Without glass and pad.		
2466 H.	30 × 42 in., . . .	each $	In ordering Print Frames please state whether pad is wanted and whether double thick or polished plate glass, or none. See Nos. N 2458 to 2461, page 169 for polished plate glass and double thick glass.	250 lb
2466 L.	36 × 48 " . . .	"		300 lb
2466 M.	36 × 60 " . . .	"		365 lb

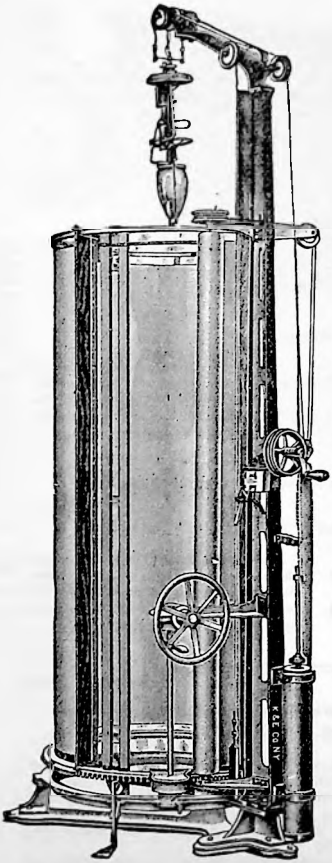
The above prices include crating for shipment.

In ordering please state: 1. Width and height of open window. 3. Width of window sill.
2. Thickness of wall. 4. Height of window sill.

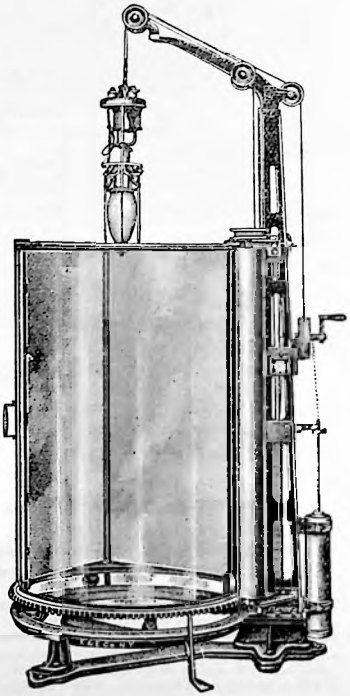
These frames represent the most practical, convenient and durable arrangement for exposing print frames outside of a window. The rails are of angle iron. The carriage, on four wheels, is well proportioned and less bulky and lighter than the usual variety, although stronger. The frame revolves in the standards of the carriage, which are provided with spring stops, as described under No. 2462, etc., page 170. The frames are our regular solid oak frames, as listed on page 167.

The carriage of frames No. 2466 is mounted on a turntable, so that the frame can be revolved on its vertical axis, to face the sun.

K & E VERTICAL CYLINDRICAL ELECTRICAL PRINT FRAMES.



No. 2468-4.



2469-2.

Nos. 2468-1 to 2468-4.

In the Electrical Print Frames Nos. 2468-1 to -4, the printing surface consists of two sections of curved glass which together form a cylinder which rotates on a circular base. The lamp is suspended in the axial line of the cylinder, and its travel is delicately regulated by an adjustable hydraulic regulator. **These frames require a floor space of about 36 x 42 inches.**

Tracings and paper are fed between the curtain and the glass by revolving the cylinder and are held in perfect contact by the tension of the curtain. The curtain is mounted on a vertical spring roller, from which it is wrapped on to or unrolled from the cylinder, which is revolved by means of a conveniently placed hand wheel.

The lamp is of special pattern, combining maximum efficiency with perfect distribution of light. The speed and length of its travel and the locating of its starting and stopping points, are under instant control of the operator. At the end of the travel of the lamp, the current is automatically cut off.

This is a very economical apparatus because it requires only one lamp, even for large tracings, and no current is used except while the lamp is printing. Tracings and paper can be inserted and removed very quickly and conveniently.

No. 2469-2.

The Electrical Print Frame No. 2469-2 is similar to No. 2468-2, except that it has only one printing surface which forms a semi-cylinder and is revolved by hand, without any gearing.

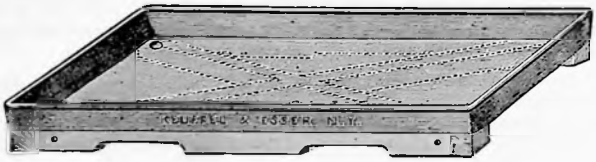
		Ship'g weight about
2468-1.	Frame complete with lamp, with two semi-cylindrical printing surfaces, each 42 × 36 in. $	1200 lb
2468-2.	" " " " " " " 42 × 48 "	1350 lb
2468-3.	" " " " " " " 42 × 60 "	1450 lb
2468-4.	" " " " " " " 42 × 72 "	1550 lb
2469-2.	Frame complete with lamp, with one semi-cylindrical printing surface, 42 × 48 in. . . . $	1000 lb

All of these frames can be furnished with lamps for either direct or alternating current, 110 or 220 volts.

In ordering, please state voltage, cycles and kind of current.

These prices include packing for shipment. The semi-cylindrical glasses are packed each in a separate case by an expert glass packer. We are not responsible for breakage of glass in transit, but we insure Plate Glass against breakage, for consignee's account, unless instructed not to insure.

SUPERIOR QUALITY ZINC BATH TRAYS.



No. 2480 H.

WITH DRAIN PIPE STRONG WIRED RIM AND HARDWOOD BRACES.

2480 E.	Zinc Bath Tray		20×24 in.	each $
2480 G.	do.	do.	24×30 "	"
2480 H.	do.	do.	30×42 "	"
2480 L.	do.	do.	36×48 "	"
2480 M.	do.	do.	36×60 "	"
2480 O.	do.	do.	42×60 "	"
2480 P.	do.	do.	42×72 "	"

PLAIN BATH TRAYS OF ZINC, WIRED RIM.



No. 2484 E.

2484 A.	Plain Bath Tray,		12×17 in.	each $
2484 C.	do.	do.	17×22 "	"
2484 E.	do.	do.	20×24 "	"
2484 G.	do.	do.	24×30 "	"

The prices of bath trays cover crating for shipment.

K & E DRAWING BOARDS.

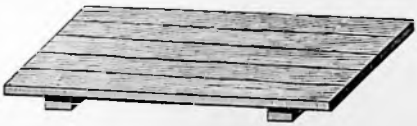
K & E Drawing Boards are the best that can be produced. They are of thoroughly seasoned, selected, narrow strips of white pine, and have a light coat of shellac. If wanted natural finish, this must be stated in the order.

Boards can be made for much less money, if other woods than white pine, which has become very scarce, are employed. They can also be made at a much cheaper figure if the material is less carefully seasoned, selected and matched, and less attention is paid to workmanship and finish.



No. 2505.

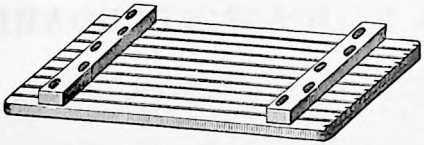
2505.	Drawing Board, white pine, with end ledges of pine, both sides presenting drawing surfaces, . . .		12 × 17 in.	each	$
2506.	do.	do.	16 × 21 "	"	
2506½.	do.	do.	18 × 23 "	"	
2507.	do.	do.	20 × 26 "	"	
2508.	do.	do.	23 × 31 "	"	
2509.	do.	do.	27 × 34 "	"	
2510.	do.	do.	31 × 42 "	"	



No. 2520.

2520.	Drawing Board, white pine, hardwood ledges attached by screws sunk in slots bushed with metal, to allow contraction or expansion, ...		16×21 in.	each	$
2521.	do.	do.	20×26 "	"	
2522.	do.	do.	23×31 "	"	
2522½.	do.	do.	26×38 "	"	
2523.	do.	do.	31×42 "	"	
2524.	do.	do.	33×55 "	"	
2525.	do.	do.	36×60 "	"	

The above prices cover crating for shipment.



No. 2530.

2530.	Drawing Board,	white pine,	hardwood ledges,		16 × 21 in.	each	$
2531.	do.	"	"	"	20 × 26 "	"	
2532.	do.	"	"	"	23 × 31 "	"	
2533.	do.	"	"	"	31 × 42 "	"	
2534.	do.	"	"	"	33 × 55 "	"	
2535.	do.	"	"	"	36 × 60 "	"	

The Drawing Boards Nos. 2530 to 2535 possess all the qualities a good and true board should have. They are of white pine, glued up to the required width, with the heart-side of each piece of wood to the surface. A pair of hardwood ledges is screwed to the back; the screws pass through the ledges in oblong slots with metal bushings, which fit closely under the heads and yet allow the screws to move freely when drawn by the contraction of the board. A series of grooves is sunk in the board on the under side. These grooves take the transverse strength out of the wood to allow it to be controlled by the ledges, leaving at the same time its longitudinal strength nearly unimpaired.

To make the working edge perfectly smooth, allowing easy movement of the T square, a strip of ebony is let into one end of the board. The strip is sawed apart at about every inch to allow for contraction of the board.

EXTRA LARGE DRAWING BOARDS.

Ship'g weight about

These boards are of the best selected white pine with hardwood ledges and are the very best boards that can be made. We carry the more current sizes in stock; other sizes are made to order.

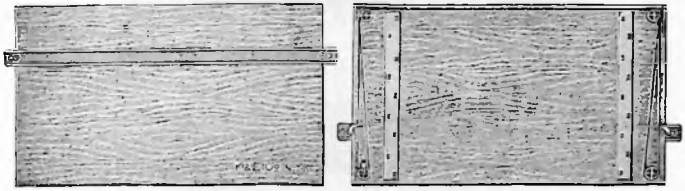
120 lb	**2538.**	Pinewood	Drawing Board,		36 × 72 in.	each	$
130 lb	"	do.	do.		36 × 84 "	"	
120 lb	"	do.	do.		42 × 60 "	"	
130 lb	"	do.	do.		42 × 72 "	"	
140 lb	"	do.	do.		42 × 84 "	"	
155 lb	"	do.	do.		42 × 96 "	"	
140 lb	"	do.	do.		48 × 72 "	"	
155 lb	"	do.	do.		48 × 84 "	"	
175 lb	"	do.	do.		48 × 96 "	"	
195 lb	"	do.	do.		48 × 108 "	"	
215 lb	"	do.	do.		48 × 120 "	"	
200 lb	"	do.	do.		54 × 96 "	"	
220 lb	"	do.	do.		54 × 108 "	"	
235 lb	"	do.	do.		54 × 120 "	"	
235 lb	"	do.	do.		60 × 96 "	"	
245 lb	"	do.	do.		60 × 108 "	"	
255 lb	"	do.	do.		60 × 120 "	"	

The above prices cover crating for shipment.

For Trestles and Horses for Boards, see page 178.

K & E PARALLEL ATTACHMENT

FOR DRAWING BOARDS AND TABLES.



The K & E Parallel Attachment insures absolutely parallel motion of the straightedge whether set horizontal or at an angle. The setting is quickly effected by releasing and tightening the clamps which hold the straightedge to the board. In the same way the straightedge can be readily removed when a T square is to be used on the board. The attachment can be applied without other directions than the above cut conveys, to any board having ledges or available space underneath.

The fixtures consist of 2 double and 2 single pulleys, (one of which is adjustable for tension of the cord), 2 clamps, the cord, and the straightedge.

2547 A. Fixtures for K & E Parallel Attachment (except straightedge) for boards $\frac{3}{4}$ in. thick . . set $

2547 B. do. do. " " 1 " " . . "

2547 C. do. do. " " $1\frac{1}{4}$ " " . . "

2547 D. do. do. " " $1\frac{3}{8}$ " " . . "

2547 is old No. 2549 M.

When ordering, please state thickness and size of the drawing board.



No. 2548.

2548. Hardwood Straightedge for K & E Parallel Attachment,
for boards 26 31 42 55 60 72 84 96 108 120 in.
each $

2548 is old No. 2549 P.



No. N 2549. with T.

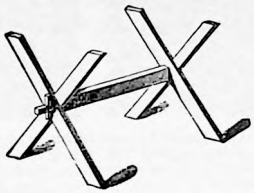
N 2549. Maple Straightedge, xylonite (transparent) lined, for K & E Parallel Attachment,
for boards 26 31 42 55 60 72 84 96 in.
each $

N 2549 is old No. 2549 S.

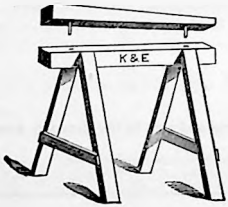
T. Ledge on straightedge, for pencils and small tools, add
T. is old No. 2549 T. per foot $

TRESTLES AND HORSES

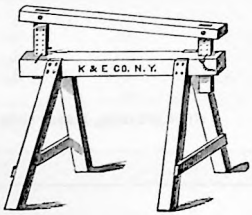
FOR DRAWING BOARDS.



Wooden Trestles, made to order only. In ordering, state size of board, to determine length and spread of trestle.



No. 2552 C.



No. 2552 D.

Ship'g weight about

42 lb **2552 A.** Wooden Horses, light construction, 37 in. high, 35 in. long . . . . . each $

42 lb **2552 B.** do. do. like No. 2552 A, fine quality, 37 in. high, 35 in. long . . . . . "

48 lb **2552 C.** do. do. fine quality, with removable Sloping Ledges, 37 in. high, 35 in. long . . . . "

48 lb **2552 D.** Adjustable Wooden Horses, fine quality, 36 in. long, adjustable for height from 37 to 47 in. on level or slope . . . . . "

The above prices cover crating for shipment.

SIMPLEX

DRAWING TABLE.



No. 2554 N.

		Ship'g weight about
2554 N.	Simplex Drawing Table, 38 in. high, board 36x60 in., drawer with lock, 24×32×2½ in . . . . . each $	150 lb

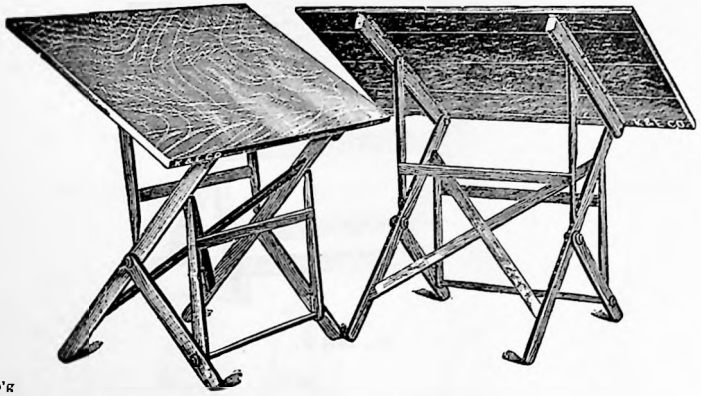
The Simplex Drawing Table is substantially constructed; the top is a high-grade drawing board. This is a very rigid and durable table, well adapted for the drafting room in technical schools.

Quotations on other sizes of these tables or on modifications in design, promptly furnished.

K & E Parallel Ruling Attachment (page 177) can be applied to the Simplex Tables.

The above prices cover crating for shipment.

UNIQUE
FOLDING TRESTLES
WITH DRAWING BOARD.



No. 2555.

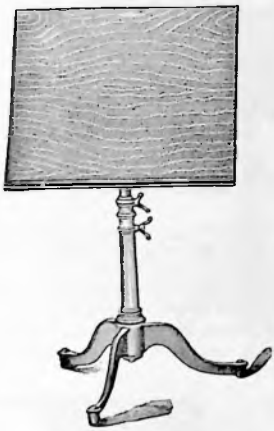
Ship'g weight about							
63 lb	**2554½.**	Unique Trestle,	Hardwood,	fine Drawing Board	23 × 31	in., each	$
70 lb	**2555.**	do.	do.	" "	" 31 × 42	"	"
80 lb	**2556.**	do.	do.	" "	" 33 × 55	"	"
110 lb	**2556½.**	do.	do.	" "	" 36 × 60	"	"
60 lb	**2557.**	Unique Trestle,	Hardwood,	plain Drawing Board	23 × 31	"	"
70 lb	**2558.**	do.	do.	" "	" 31 × 42	"	"
80 lb	**2559.**	do.	do.	" "	" 33 × 55	"	"
110 lb	**2559½.**	do.	do.	" "	" 36 × 60	"	"

The Unique Folding Trestles combine simplicity of construction with great range of adjustment and firmness in any position. The range of adjustment is from 31 to 41 inches for height, and from horizontal to about 45 degrees for slant of board. When folded, these trestles occupy but a few inches in thickness.

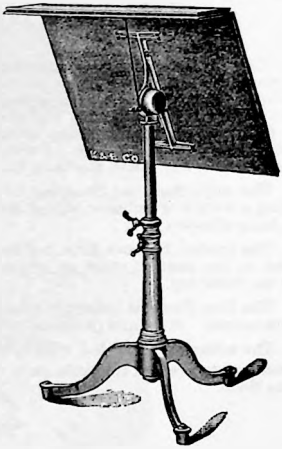
K & E Parallel Ruling Attachment (page 177), can be applied to these boards.

The above prices cover crating for shipment.

COLLEGE DRAWING TABLES.



No. 2560.



2561 with Accessory T. $

		Ship'g weight about
2560.	College Drawing Table, polished ash top, 21x24 in. . . . each $	60 lb
2561.	do. do. " " 22x26 " . . . "	65 lb

These tables are crated for shipment without extra charge.

ACCESSORIES FOR COLLEGE DRAWING TABLES.

T. Top Shelf, 6½ in. wide, remaining horizontal at any inclination of the table top . . . . . extra each $

D. Top Shelf as above, but with two drawers . . . " "

Casters on College Drawing Tables (2 casters and 1 iron foot), extra, per table

Our College Drawing Tables possess all the features of an efficient and satisfactory

DRAWING STAND FOR THE CLASS ROOM.

The top is of ashwood, highly finished, and can be clamped horizontal or at any angle by a conveniently placed clamp, which locks it absolutely and rigidly. It is attached to a strong spindle, on which it can be rotated after releasing the clamping screw. There is a sliding collar with a clamp screw on the spindle, by clamping which, the height of the table is regulated. The table stands 30 inches high and can be raised to 42 inches, and the top can be placed at any height within this range or at any inclination The top shelf or ledge (see cut No. 2561 with T.) for drawing instruments, inks, etc., remains horizontal at any inclination of the table top.

FAVORITE DRAWING TABLES.

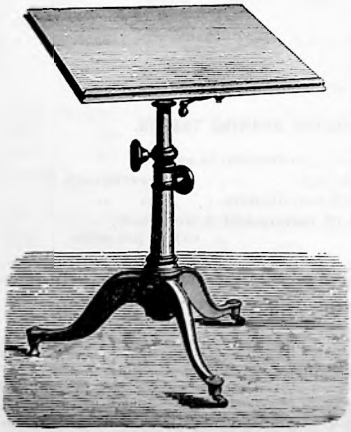
The Favorite Drawing Tables are in use in a good many offices and drafting rooms and in colleges and schools of the very highest standing. They give such perfect satisfaction that we confidently recommend them as the best of all in material, workmanship and practical construction. They are more **rigid** and **durable** than most drawing tables and have valuable improvements which are not found on other tables. Owing to their elegant appearance they are also an ornament to any office, studio or library.

The adjusting and clamping of the top to any desired slant is done by shifting a lever conveniently placed under the front of the table top, which locks the clamp absolutely.

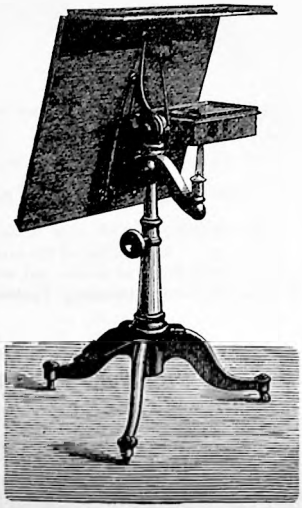
The jointed Bracket Arm, holding the Shelf and Drawer, can be readily moved to any desired point on either side of the table and raises or lowers with the table top.

The Iron Footrest, which is detachable, is an improvement of value, and is ornamental. It admits of a comfortable position while working.

The tables are provided with casters (on two of the legs); the third leg has an iron foot to prevent the table from rolling, except when the iron foot is lifted off the floor.

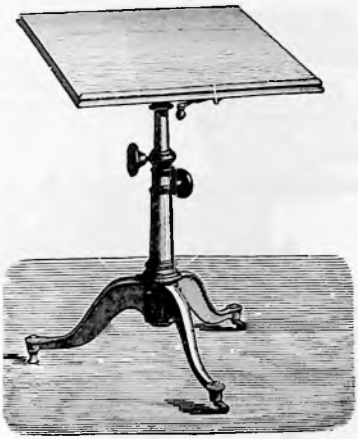


No. 2570.



No. 2571 with Accessories B. C. E.

FAVORITE DRAWING TABLES.



No. 2570.

			Ship'g weight about
2570.	Favorite Drawing Table, ash or oak Top 21 × 24 in. . . .	each $	70 lb
2571.	do. do. " " " " 22 × 26 " . . .	"	75 lb
M.	Polished Mahogany Top	extra "	

ACCESSORIES

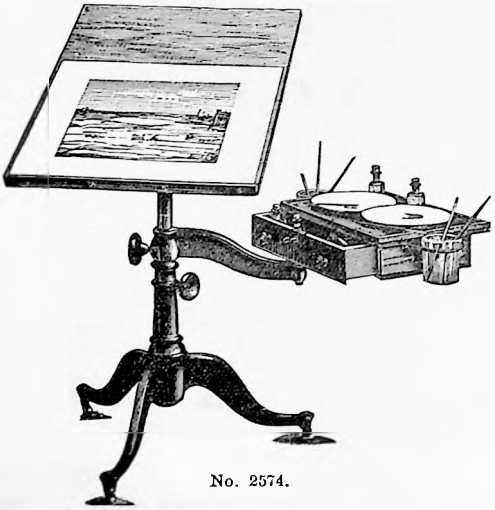
FURNISHED TO ORDER WITH FAVORITE DRAWING TABLES.

A.	Folding Arm with plain Shelf	each $
B.	do. " Shelf and Drawer with Lock	"
C.	Detachable Iron Footrest	"
E.	Top Shelf, without Drawers	"
F.	do. with two "	"
G.	Folding Arm with large Shelf, Drawer, etc., as shown with table No. 2574 on next page	"

These Tables are crated for shipment without extra charge.

FAVORITE DRAWING TABLE.

SPECIALLY ADAPTED FOR WATER-COLOR WORK.



No. 2574.

Ship'g weight about

75 lb **2574.** Favorite Drawing Table, ash or oak Top 21 × 26 in., Folding Arm with large Shelf, Drawer with Lock, and two Holders for water glasses . . . . . each $

M. Polished Mahogany Top . . . . . extra "

For Accessories, see page 183.

DRAFTSMEN'S STOOLS

These stools are of practical construction and especially designed for the requirements of the draftsman. They are of good quality and firmly mounted on iron base, with casters, to allow them to be easily moved along the drawing board.

30 lb **2593-1.** Draftsman's Stool, cane seat, 20½ in. each $

35 lb **2593-2.** do. do. do. 26½ " "

40 lb **2593-3.** do. do. do. 32½ " "

35 lb **2593-4.** do. do. swiveling cane seat with screw; raising of seat independent of swiveling device, 22½ in., cane seat, each $

40 lb **2593-5.** do. do. 26½ " do. "

45 lb **2593-6.** do. do. 32½ " do. "

The above prices cover crating for shipment.

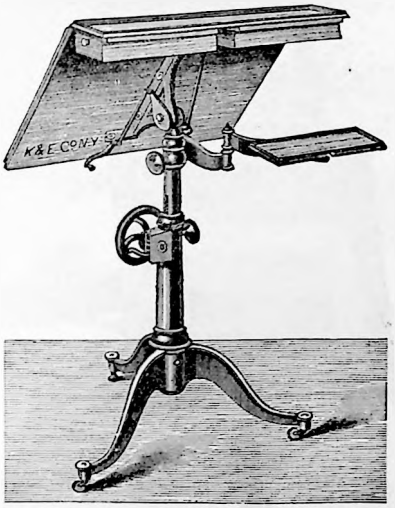


No. 2593-5.

FAVORITE DRAWING TABLES

WITH WHEEL LIFT.

These tables are provided with a wheel lift consisting of a rack and pinion movement, which raises and lowers the table top. This lift is worked by a large hand wheel, and is so simple to operate that a child can handle it.



No. 2576 with Accessories, A. F. $

			Ship'g weight about
2575.	Favorite Drawing Table, ash or oak Top 21 × 24 in. . . each	$	75 lb
2576.	do. do. " " " " 22 × 26 " . . "		75 lb
M.	Polished Mahogany Top . . . . . extra "		

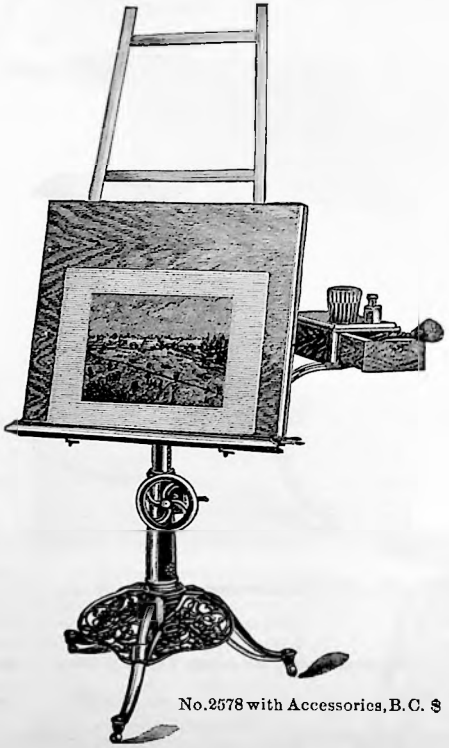
For Accessories, see page 183.

These Tables are crated for shipment without extra charge.

FAVORITE DRAWING TABLE

WITH WHEEL LIFT.

This Table has the Wheel Lift for raising and lowering the table top, as described on the preceding page. It can be converted into an Easel by setting the hinged lower edge of the table top at right angles, where it is held by catches. The rack for studies, shown in the cut, can be folded behind the table top when not in use.



No. 2578 with Accessories, B. C. $

Ship'g weight about

80 lb. **2578.** Favorite Drawing Table, Polished Ash Top 26 × 26 in. each $

FOR ACCESSORIES, SEE PAGE 183.

These Tables are crated for shipment without extra charge.

OFFICE

FAVORITE DRAWING TABLES.

The top of these Tables is a fine white pine drawing board. On each of the two columns is a rack and pinion for raising and lowering the top and a patent clamping attachment for adjusting the slant. The two racks and pinions are operated by one wheel (Wheel-lift) and the two clamps for the table top are locked by one lever, the handle of which is at the front edge of the table. The footrest is of hardwood. These tables are of very fine quality and highly finished.



No. 2583-1 with Accessories R. T., $

		Ship'g weight about
2583-1.	Office Drawing Table, with Drawing Board 36 × 60 in., each $	270 lb
2583-2.	do. do. " " " 42 × 72 " "	300 lb

These Tables are crated for shipment without extra charge.

ACCESSORIES

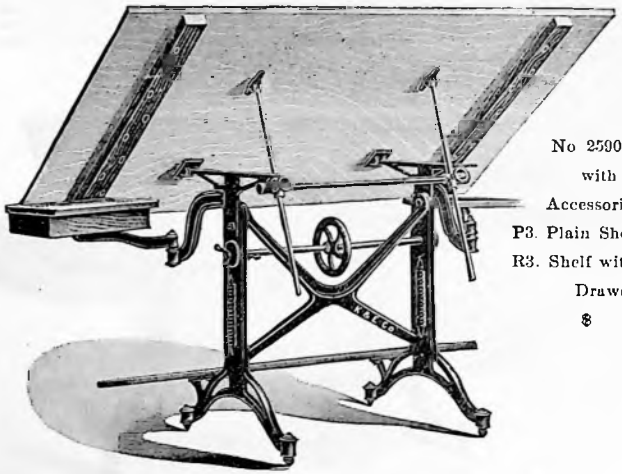
FOR "OFFICE" DRAWING TABLES.

R. Folding Arm with Shelf . . . . . each $
S. Folding Arm with Shelf and Drawer with Lock . . . . "
T. Bracket with Hardwood Cabinet with 2 Drawers with Locks . . . . . "

K & E Parallel Attachment (page 177) can be applied to these tables.

AMERICAN DRAWING TABLE.

The "American" is a very practical drawing table, rigid, substantial, capable of free adjustment, and durable. It is 36 in. high and can be raised to 48 in. by a rack and pinion in each of the two iron standards, operated by one large hand wheel. The top is a white pine drawing board of fine quality, hinged to the standards. It can be slanted, up to the vertical, when it can be used as an upright board. It is held rigid by iron rods with clamp screws. The footboard is of hardwood.



No 2590 E with Accessories P3. Plain Shelf R3. Shelf with Drawer.

Ship'g weight about					
220 lb	**2590 A.**	American Drawing Table, board	31 × 42 in.	each	$
230 lb	**2590 B.**	do.	do.	33 × 55 "	"
240 lb	**2590 C.**	do.	do.	36 × 60 "	"
250 lb	**2590 D.**	do.	do.	36 × 72 "	"
275 lb	**2590 E.**	do.	do.	42 × 72 "	"
340 lb	**2590 F.**	do.	do.	42 × 84 "	"
350 lb	**2590 G.**	do.	do.	42 × 96 "	"
330 lb	**2590 H.**	do.	do.	48 × 72 "	"
350 lb	**2590 I.**	do.	do.	48 × 84 "	"
375 lb	**2590 K.**	do.	do.	48 × 96 "	"
400 lb	**2590 L.**	do.	do.	48 × 108 "	"
425 lb	**2590 M.**	do.	do.	48 × 120 "	"
450 lb	**2590 O.**	do.	do.	54 × 120 "	"

These Tables are crated for shipment without extra charge.

ACCESSORIES FOR AMERICAN DRAWING TABLES.

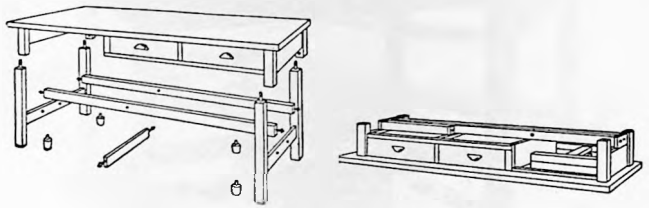
P 3. Jointed Arm with plain Shelf . . . . . each $
R 3. " " " Shelf and one Drawer with Lock . . " "
T 3. Bracket with Hardwood Cabinet with 3 Drawers, 16 × 6¾ × 3 in. inside, with Locks . . . . . "

The K & E PARALLEL ATTACHMENT, page 177, can be applied to these tables.

HUDSON DRAWING TABLES.

The Hudson Tables are of practical design, and well made. (See description, page 166.)

We frequently furnish drawing tables of these and similar styles in large lots to Schools and Drafting Rooms, and solicit an opportunity to submit designs and estimates when drawing tables are wanted.



To reduce cost of transportation, Hudson Drawing Tables Nos. 2599 C to 2599 W are now built with the main parts BOLTED to allow of their being "KNOCKED DOWN" for compact crating. This construction permits of setting up or taking down these tables, quickly and easily, makes them very convenient to move or transport, and does not detract in any degree from their strength or rigidity.

Raising Blocks 2 in. or 3 in. high furnished with all Hudson Drawing Tables, if desired, without extra charge.



No. 2599 W.

Ship'g weight about

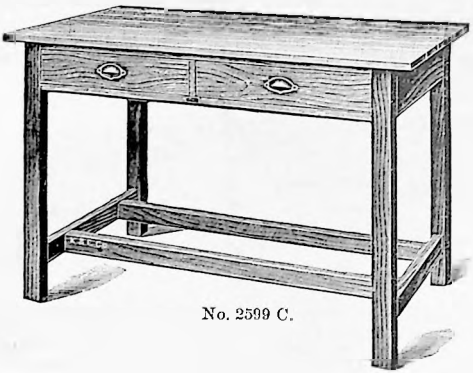
165 lb **2599 W.** Hudson Drawing Table, hardwood. The top is a drawing board of white pine 33 × 55 inches. The table stands 36 in. high. Two drawers 20 × 24 × 4 in. inside. Cabinet, about 10½ × 29 × 20 in., with grooves for drawing boards. **Made to order only.**

This type represents a special drawing table with cabinet for storing drawing boards, suitable for schools.

We make drawing tables according to design or specifications.

We solicit correspondence and cheerfully furnish estimates.

HUDSON DRAWING TABLES.



No. 2599 C.

Ship'g weight about

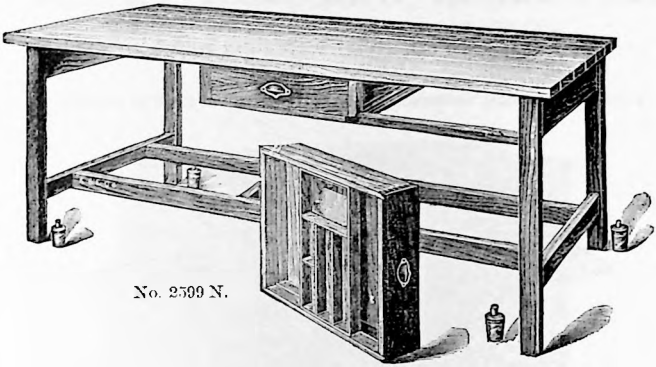
135 lb **2599 C.** Hudson Drawing Table, hardwood. The top is a drawing board of white pine 33 × 55 inches. Two drawers, 20 × 24 × 4 in. inside. The table stands 36 in. high. each $



No. 2599 F.

160 lb **2599 F.** Hudson Drawing Table, hardwood. The top is a drawing board of white pine 86 × 60 inches. One drawer 26 × 87 × 2 in., other drawer 14 × 24 × 4 in. inside. The table stands 34 in. high . . . . . each $

HUDSON DRAWING TABLES.



No. 2599 N.

2599 N. Hudson Drawing Table, hardwood. The top is a white pine drawing board, 42×84 inches. One drawer 20×24×4 in. inside, with partitioned sliding tray; other drawer 26×37 ×4 in. inside. The table stands 34 in. high, and is furnished with raising blocks 3 in. high . . . . . each $

Ship'g weight about 250 lb



No. 2599 S.

2599 S. Hudson Drawing Table, hardwood. The top is a drawing board of white pine, 42 × 84 inches. Two drawers 20 × 24 × 4 in., one of them with partitioned sliding tray. Paneled cabinet with 4 drawers 31 × 42 × 2½ in. inside, with guard across rear end to prevent papers from working over the end. The table stands 34 in. high and is provided with raising blocks 3 in. high . . . . . each $

335 lb

MAGAZINE DRAWING TABLE.

QUARTERED OAK, FINEST GOLDEN OAK FINISH.

A COMPACT, PRACTICAL COMBINATION OF DRAWING TABLE AND CHEST OF DRAWERS.



No. 2594.

Ship'g weight about 360 lb

2594. Magazine Drawing Table, quartered oak, finest golden oak finish . . . . . each $

This combined Chest and Drawing Table is 34 in. high. The sides and back of the chest are paneled. 7 drawers 31 × 42 in., 2½ in. deep, with lock. The drawers have a guard across the rear end to prevent papers from working out. The top is a fine drawing board 35 × 48 in., of selected white pine, and is hinged to a sliding frame, on which it can be slanted by means of supports catching in tooth plates. This sliding frame can be moved out beyond the front edge of the chest (as shown in cut) where it is held by a catch engaging automatically in a rack. The spaces on the top of the table, under the drawing board, can be used for tools, etc.

CHESTS OF DRAWERS.



No. 2596.

		Ship'g weight about
2595.	Chest of Drawers, **quartered oak, paneled, finest golden oak finish,** 33 in. high, top 35 × 48 in., 7 drawers 31 × 42 in., 2½ in. deep, with guard across the rear end to prevent papers from working out, drawers with Lock . each $	340 lb
2596.	Chest of Drawers, **hardwood, paneled, antique oak finish** similar to No. 2595, 33 in. high, top 35 × 48 in., 8 drawers 31 × 42 in., 2½ in. deep, with guard across the rear end to prevent papers from working out (no lock). "	320 lb

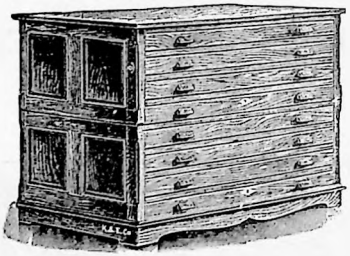
The above prices cover crating for shipment.

Chests of drawers of other dimensions or design made to order from drawings and specifications.

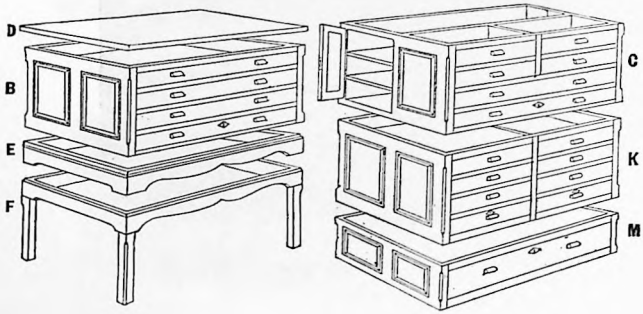
CHESTS OF DRAWERS, IN SECTIONS.

QUARTERED OAK, FINEST GOLDEN OAK FINISH.

Ship'g weight about 390 lb



No. 2597.
B. B. D. E.
$



2597 B.	Regular Section, 4 Drawers 31 ×42×2½ in. inside . . . each	$
2597 C.	Special Section, 4 Drawers 15½×20×2½ in., 2 Drawers 15½×42×2½ in. inside and 3 full length Compartments for rolls of paper etc., both ends with door with spring catch	"
	6 in. inside	"
2597 D.	Polished Hardwood Top 35×48 in.	"
2597 E.	" " Base	"
2597 F.	" " Sanitary Base	"
2597 K.	Special Section, 8 Drawers 20×31×2½ in. inside	"
2597 M.	" " with 1 deep Drawer with Lock, 31×42×6 in. inside.	

The above prices cover crating for shipment.

These Sectional Chests, consisting of base, sections and top, admit of arbitrary change in the capacity of the composite chest, in much the same manner as such changes may be effected in the well-known sectional book cases. They are of quartered oak, golden oak finish and of very best workmanship.

The drawers in Sections (B. and C.) are simultaneously locked or unlocked by an ingenious device. A chest consisting of two sections with base E, and top is 38 in. high. Sections B, and C. are 16½ in. high, Section M 8 in., Base E. 3¼ in., Base F. 16½ in.

The drawers have a guard across the rear end to prevent papers from working out.

CHESTS OF DRAWERS IN SECTIONS

of other sizes, for storing drawings, tracings and paper, made to order. When writing for estimates please give all particulars, such as dimensions of chest, number and depth of drawers, kind and finish of wood, whether drawers are to be on rollers, with lock, etc., etc.

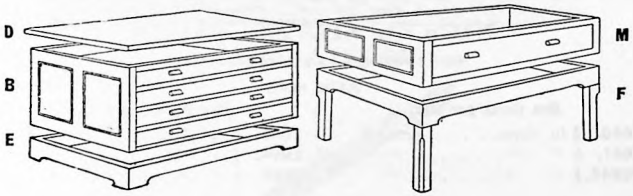
CHESTS OF DRAWERS IN SECTIONS.

HARDWOOD, ANTIQUE OAK FINISH.



No. 2598.
B. B. D. E.

Ship'g weight about 380 lb



2598 B. Regular Section of 4 Drawers, 31 × 42 × 2½ in. inside . each $ 230 lb
2598 D. Polished Hardwood Top, 35 × 48 in. . . . . "
2598 E. " " Base . . . . . "
2598 F. " " Sanitary Base, 16½ in. high . . . . . "
2598 M. Special section with one deep drawer 31 × 42 × 6 in. inside "

The above prices cover crating for shipment.

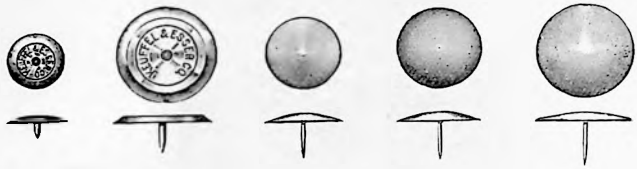
These Sectional Chests, consisting of base, sections and top, admit of arbitrary changes in the capacity of the composite chest, in much the same manner as such changes may be effected in the well-known sectional book cases. They are thoroughly well made, of **hardwood, antique oak finish.** The drawers have a guard across the rear end to prevent papers from working out (no lock).

Section B is 14½ in. high,—Section M, 8 in.—Base E, 3½ in.—Base F, 16½ in.

CHESTS OF DRAWERS IN SECTIONS

of other sizes, for storing drawings, tracings and paper, made to order. When writing for estimates please give all particulars, such as dimensions of chest, number and depth of drawers, kind and finish of wood, whether drawers are to be on rollers, with lock, etc., etc.

DRAWING PINS OR THUMB TACKS.



No. 2622. 2636. 2641. 2651. N 2662.

FINE NICKEL SILVER TACKS.

TOOL STEEL POINTS, SCREWED AND RIVETED. ONE DOZEN ON A CARD.

ROUND HEAD.		BEVELED HEAD.	
2622. $\frac{3}{8}$ in. diam. . . . . doz. $		**2632.** $\frac{3}{8}$ in. diam. . . . . doz. $	
2624. $\frac{1}{2}$ " " . . . . . "		**2634.** $\frac{1}{2}$ " " . . . . . "	
2626. $\frac{5}{8}$ " " . . . . . "		**2636.** $\frac{5}{8}$ " " . . . . . "	

NICKEL SILVER TACKS.

HIGHLY FINISHED. STEEL POINTS SWAGED.

ROUND HEAD.

One Gross per Box.		One Dozen on a Card.	
2640. $\frac{3}{8}$ in. diam. . . . . gross $		**2643.** $\frac{3}{8}$ in. diam. gr. $	doz. $
2641. $\frac{1}{2}$ " " . . . . . "		**2644.** $\frac{1}{2}$ " " "	"
N2642. $\frac{5}{8}$ " " . . . . . "		**2645.** $\frac{5}{8}$ " " "	"

BRASS TACKS.

HIGHLY FINISHED. STEEL POINTS SWAGED.

ROUND HEAD.

One Gross per Box.		One Dozen on a Card.	
2650. $\frac{3}{8}$ in. diam. . . . . gross $		**2653.** $\frac{3}{8}$ in. diam. gr. $	doz. $
2651. $\frac{1}{2}$ " " . . . . . "		**N2654.** $\frac{1}{2}$ " " "	"
N2652. $\frac{5}{8}$ " " . . . . . "		**2655.** $\frac{5}{8}$ " " "	"

STEEL TACKS.

NICKELPLATED. STEEL POINTS SWAGED.

ROUND HEAD.

One Gross per Box.		One Dozen on a Card.	
2660. $\frac{3}{8}$ in. diam. . . . . gross $		**2663.** $\frac{3}{8}$ in. diam. gr. $	doz. $
2661. $\frac{1}{2}$ " " . . . . . "		**N2664.** $\frac{1}{2}$ " " "	"
N2662. $\frac{5}{8}$ " " . . . . . "		**2665.** $\frac{5}{8}$ " " "	"

FOR STAMPED STEEL TACKS, SEE NEXT PAGE.

STAMPED STEEL TACKS.





No. 2677.



2678.



2679.

PLAIN.

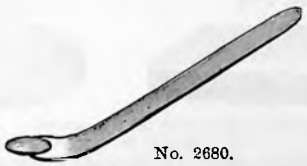
One Box of 100.	One Dozen on a Card.
2677. $\frac{3}{8}$ in. diam. . . . . doz. $	2677C. $\frac{3}{8}$ in. diam. . . . . doz. $
2678. $\frac{7}{16}$ " " . . . . . "	2678C. $\frac{7}{16}$ " " . . . . . "
2679. $\frac{9}{16}$ " " . . . . . "	2679C. $\frac{9}{16}$ " " . . . . . "
2677½. $\frac{3}{8}$ " " box of 12 each	

NICKELPLATED.

One Box of 100.	One Dozen on a Card.
2677N. $\frac{3}{8}$ in. diam. . . . . box $	2677NC. $\frac{3}{8}$ in. diam. . . . doz. $
2678N. $\frac{7}{16}$ " " . . . . . "	2678NC. $\frac{7}{16}$ " " . . . "
2679N. $\frac{9}{16}$ " " . . . . . "	2679NC. $\frac{9}{16}$ " " . . . "

These Stamped Steel Tacks are made of one piece of tough, hard steel (especially made for this purpose) and are of the very best quality. They have needle finished points, so that they make an excellent substitute for the regular thumb tacks whenever a lower priced article is desired.

TACK LIFTER.



No. 2680.

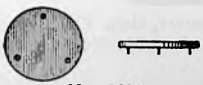
2680. Tacklifter and Paper Knife, Brass, Nickelplated, 5½ in. . . each $

A handy and simple instrument for extracting thumb tacks. The end of the lifter is inserted under the head of the tack which it takes out without bending the point or wrenching off the head, as is frequently the case when a knife is used.

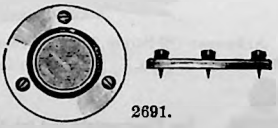
The handle of this instrument is a Paperknife, useful for removing drawings which have been glued to the board, etc.

(See also Lead Pencil File and Tacklifter page 224).

HORNCENTERS.



No. 2690.



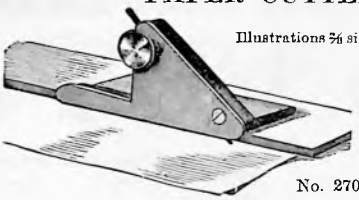
2691.

2690. Horncenter, plain, ¼ in. diam. . . . . each $

2691. do. with nickel silver rim, ¾ in. diam. . . . "

PAPER CUTTERS.

Illustrations 2/5 size.



No. 2701.



2703.

2701. Handy Paper Cutter, Nickelplated . . . . . each $

2703. Safety Paper Cutter, " . . . . . "

These little instruments are of important service to Draftsmen for cutting drawings from the board as well as for cutting any kind of paper or Bristol board. They are slid along the ruler or T Square and will not injure its edge, as an ordinary knife would do. The blade of these Cutters can be adjusted to cut only the thickness of the paper without striking the drawing board. The knife of No. 2701 is set and clamped, while the cutter of No. 2703 is adjustable by means of the thumbscrew projecting above the instrument. The knife can be removed from either instrument, for sharpening.

PAPERWEIGHTS.

2705. Paperweight, Shot in lined chamois bag impervious to lead dust; a very practical paperweight, about 2 pounds . . . . . each $

2706. Paperweight, like No. 2705, but weight about 3 pounds "

No. 2710.



No. 2715.



2710. Lead Paperweight, covered with leather, about 4 × 2¼ × ⅝ in., about 2¾ pounds, each $

2715. Iron Paperweight, round, with knob, about 2 pounds, . . . each $

This Iron Paperweight is finely finished and cloth lined. The knobs are of polished hardwood.

ARKANSAS OIL STONES.

No. 2720.



2720. Arkansas Oil Stone, hard, in case with cover, about 3 in. . . each $

2730N. do. do. do. knife blade, about 3½ × ¾ × ¼ in. "



For Paperweight and Ink Bottle Holder, see No. 3018, page 206.

BOURGEOIS' WATER COLORS.



In octagonal crystal jars with cover forming saucer.

2914.	33. Brown Ochre	8. Light Red	
	54. Burnt Sienna	53. Raw Sienna	
	52. Burnt Umber	51. Raw Umber	
	41. Dragon's Blood	9. Vandyke Brown	
	38. Indian Red	34. Yellow Ochre	each $
2915.	65. Brilliant Yellow	28. Lamp Black	
	44. Brown Pink	22. Naples Yellow	
	3. Chinese White	46. Neutral Tint	
	77. Dark Purple	59. Olive Green	
	26. Green Lake	13. Payne's Grey	
	61. Hooker's Green	40. Venetian Red	
	45. Italian Pink	87. Violet Dark Extra	
	30. Ivory Black		each $
2916.	6. Antwerp Blue	14. Indigo	
	92. Brown Madder	16. Lemon Yellow	
	57. Chrome Green, Dark	7. Prussian Blue	
	55. Chrome Green, Light	60. Prussian Green	
	56. Chrome Green, Medium	105. Rose Carthame, Dark	
	18. Chrome Yellow	104. Rose Carthame, Light	
	19. Chrome Yellow, Dark	63. Sap Green	
	67. Crimson Lake	100. Scarlet Lake	
	109. Cypress Green, Dark	42. Sepia	
	108. Cypress Green, Light	75. Ultramarine Blue, Dark	
	11. Emerald Green	74. Ultramarine Blue, Light	
	12. Gamboge	86. Violet Light Extra	
	96. Geranium Rose	43. Warm Sepia	each $
2917.	117. Cadmium Deep	95. Cerulean Blue	
	114. Cadmium Lemon	112. Cobalt Blue	
	115. Cadmium Yellow	102. Madder Lake, Dark	
	5. Celestial Blue	101. Madder Lake, Light	
			each $
2918.	119. Indian Yellow		
	80. Vermilion Dark		
	79. Vermilion Light		each $

KEUFFEL & ESSER CO. NEW YORK

WINSOR & NEWTON'S

WATER COLORS.

Full Cake. F.





Full Pan. FP.

Half Cake. H.





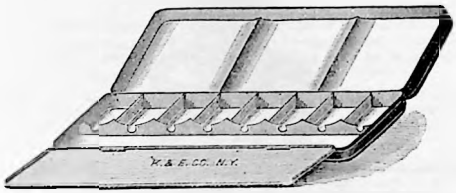
Half Pan. HP.

2920.	1. Antwerp Blue	12. Cologne Earth	28. Naples Yellow		
	2. Bistre	* 13. Constant White	29. Neutral Tint		
	3. Blue Black	†116. Cyprus Umber	30. New Blue		
	*4. British Ink	15. Dragon's Blood	32. Payne's Grey		
	5. Brown Ochre	17. Flake White	101. Permanent Blue		
	6. Brown Pink	19. Hooker's Green, No. 1	31. Prussian Blue		
	*7. Bronze	20. do. do. 2	35. do. Green		
	8. Burnt Sienna	22. Indian Red	36. Raw Sienna		
	9. Burnt Umber	24. Ivory Black	37. Raw Umber		
	34. Charcoal Grey	25. King's Yellow	40. Roman Ochre		
	†115. Chinese Blue	26. Lamp Black	42. Terre Verte		
	10. Chinese White	27. Light Red	43. Vandyke Brown		
	14. Chrome, Deep	†100. Mauve	44. Venetian Red		
	95. do. Lemon	†117. Naples Yellow (deep)	47. Yellow Lake		
	32. do. Orange		48. Yellow Ochre		
	11. do. Yellow			CAKE or PAN	
				Full	Half
			doz.	$	$
2921.	96. Alizarin Crimson	16. Emerald Green	†120. Orange Madder (Alizarin)		
	102. do. Green	18. Gamboge	56. Purple Lake		
	103. do. Orange	21. Indigo	57. Roman Sepia		
	104. do. Scarlet	23. Italian Pink	58. Ruben's Madder		
	105. do. Yellow	†106. Leitch's Blue	41. Sap Green		
	* 49. Black Lead	†119. Madder Carmine (Alizarin)	59. Scarlet Lake		
	50. Brown Madder		61. Sepia		
	51. Carmine Lake	54. Mars Yellow	62. Warm Sepia		
	52. Crimson Lake	55. Neutral Orange	doz.		
	118. Cyanine Blue	81. Olive Green			
2922.	†114. Cadmium Lemon	75. Intense Blue	98. Permanent Mauve		
	69. do. Orange	76. Lemon Yellow	99. Permanent Violet		
	68. do. Yellow	87. Mars Orange	77. Pale Cadmium Yellow		
	†121. Cadmium Yellow (extra pale)	†123. Mineral Grey	79. Pure Scarlet		
		†124. Mineral Violet	60. Scarlet Vermilion		
	63. Cobalt Blue	†107. Emerald Oxide of Chrome	†109. Ultramarine Ash-grey		
	97. do. Green	64. Orange Vermilion	45. Vermilion		
	71. French Blue	73. Oxide of Chromium	125. Veronese Green		
	†122. French Ultramarine	†108. do. transparent	81. Viridian		
	74. Indian Purple		doz.		
	53. Indian Yellow				
2923.	66. Aureolin	110. Gallstone	82. Purple Madder		
	91. Aurora Yellow	86. Madder Carmine	112. Rose Doree		
	67. Burnt Carmine	111. do. Lake	90. Scarlet Madder		
	70. Carmine	†127. New Olive Green	80. Rose Madder		
	89. Cerulean Blue	78. Pink Madder	65. Violet Carmine		
	†126. Cobalt Yellow	92. Primrose Aureolin	93. Yellow Carmine		
	85. Field's Orange Vermilion		doz.		
2924.	84. Ultramarine Ash Blue.			doz.	
2925.	88. Genuine Ultramarine			½ Cake, each $	

Colors marked * are made ONLY in CAKES, and those marked † ONLY in PANS.

EMPTY JAPANNED TIN BOXES.

for Moist Colors in Pans.



No. 2951.

| | | |

HIGGINS' INKS AND ADHESIVES.



No. 2970

	Small (¼ oz.)	Half Pints (8 oz.)	Pints (16 oz.)	Quarts (32 oz.)
Black, Waterproof.	2969. ea. $	2969D. ea. $	2969E. ea. $	2969F. ea. $
" General.	2970. "	2970D. "	2970E. "	2970F. "
Carmine.	2971. "	2971D. "	2971E. "	2971F. "
Scarlet.	2972. "	2972D. "	2972E. "	2972F. "
Vermilion.	2973. "	2973D. "	2973E. "	2973F. "
Brick red.	2974. "	2974D. "	2974E. "	2974F. "
Blue.	2975. "	2975D. "	2975E. "	2975F. "
Green.	2976. "	2976D. "	2976E. "	2976F. "
Violet.	2977. "	2977D. "	2977E. "	2977F. "
Indigo.	2978. "	2978D. "	2978E. "	2978F. "
Brown.	2979. "	2979D. "	2979E. "	2979F. "
Yellow.	2980. "	2980D. "	2980E. "	2980F. "
Orange.	2981. "	2981D. "	2981E. "	2981F. "
White.	2982. "	2982D. "	2982E. "	2982F. "



No. 2985.



2986.



2987.

Higgins' Drawing Board and Library Paste, each $	3 oz. 2985.	6 oz. 2985D.	14 oz. 2985E.	half gallon 2985H.	gallon 2985G.
Higgins' Taurine Mucilage, each $	2 oz. 2986.	4 oz. 2986C.	½ pint 2986D.	pint 2986E.	quart. 2986F.
Higgins' Office Paste, each $		4 oz. 2987C.	7 oz. 2987D.		

COLUMBIA
LIQUID INDELIBLE DRAWING INKS.

Columbia Indelible Inks meet all the requirements of a perfect Drawing Ink, i. e. they are always ready for use and always uniform in quality and color; they flow freely, dry readily, and are not apt to gum. This brand of ink may be thoroughly relied upon for general drafting purposes.

All these Inks are indelible in that they will not re-dissolve after drying, a feature variously described as indelible, waterproof, washable, etc. Lines drawn with these inks will not blur nor be defaced by brush tints, even frequently applied, or by exposure to moisture in out-door use.

The Colored Columbia Drawing Inks are perfect inks of their kind, including the blue which is the most difficult color, and which has not been produced in perfection in any other ink. They all are freely miscible for producing other tints.

Columbia Inks Nos. 3000 to 3009 are put up in round bottles provided with our improved ink filler. This consists of a glass tube with flattened capillary end, which can be inserted *between* the blades of a drawing pen and is provided with a rubber suction bulb enclosed in a rigid annular collar, which protects it during transportation and serves as a handle to prevent deflection of the tube when filling a pen. This device is so cleanly that it dispenses with the usual wiping of the pen after filling (no pen-wiper). There is no soiling of the pen or fingers (or of the drawing), and the glass filler cannot become soft and limp.



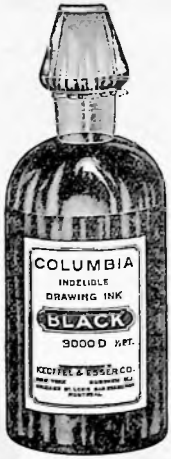
No. 3000.

Columbia Indelible Drawing Ink, round bottle, improved glass filler,

3000.	Black	each $	3005.	Carmine	each $
3001.	Brown	"	3006.	Yellow	"
3002.	Blue	"	3007.	Vermilion	"
3003.	Green	"	3008.	Orange	"
3004.	Scarlet	"	3009.	Violet	"

For bottle holders for Columbia Ink, see Nos. 3018 and 3019, page 206.

COLUMBIA
LIQUID INDELIBLE DRAWING INKS
IN LARGE BOTTLES.



QUARTER PINTS.

Black,	3000 C,	each $
Brown,	3001 C,	"
Blue,	3002 C,	"
Green,	3003 C,	"
Scarlet,	3004 C,	"
Carmine,	3005 C,	"
Yellow,	3006 C,	"
Vermilion,	3007 C,	"
Orange,	3008 C,	"
Violet,	3009 C,	"

HALF PINTS.

Black,	3000 D,	each
Brown,	3001 D,	"
Blue,	3002 D,	"
Green,	3003 D,	"
Scarlet,	3004 D,	"
Carmine,	3005 D,	"
Yellow,	3006 D,	"
Vermilion,	3007 D,	"
Orange,	3008 D,	"
Violet,	3009 D,	"

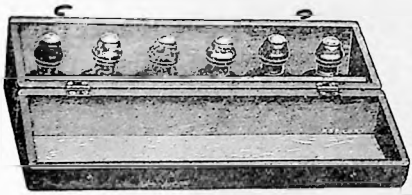
PINTS.

Black,	3000 E,	each $
Brown,	3001 E,	"
Blue,	3002 E,	"
Green,	3003 E,	"
Scarlet,	3004 E,	"
Carmine,	3005 E,	"
Yellow,	3006 E,	"
Vermilion,	3007 E,	"
Orange,	3008 E,	"
Violet,	3009 E,	"

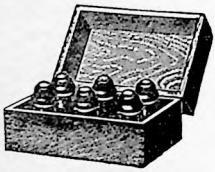
QUARTS.

Black,	3000 F,	each
Brown,	3001 F,	"
Blue,	3002 F,	"
Green,	3003 F,	"
Scarlet,	3004 F,	"
Carmine,	3005 F,	"
Yellow,	3006 F,	"
Vermilion,	3007 F,	"
Orange,	3008 F,	"
Violet,	3009 F.	"

COLORED COLUMBIA INKS IN SETS.



No. 3010.



No. 3011.

3010. Polished Mahogany Box, containing 6 bottles of any colors of Nos. 3000 to 3009, set $

3011. Plain Wooden Box, containing 6 bottles of any colors of Nos. 3000 to 3009, set $



No. 3013.



No. 3014.

3012. "NO-RINKLE-BLAK." A black liquid for filling in with a brush between lines on Tracing Cloth, without wrinkling the cloth, thus insuring perfect contact in photo-printing; ¾ oz. bottle. . . . . per bottle $

3013. "NO-RINKLE" Tracing Cloth Colors. Carmine, Scarlet, Vermilion, Brick Red, Blue, Violet, Brown, Yellow, Orange, Green, Brass; ¾ oz. bottle . . . . . per bottle $

By using "No-Rinkle" colors, the scale to which a tracing is made remains unaffected. "No-Rinkle" colors are in a liquid state ready for use, and may be applied with a soft brush, as with water colors.

3014W. "CRYSTALLINE" INK, White . . . . . per bottle $
3014R. " " " Red . . . . . " "
3014Y. " " " Yellow . . . . . " "

In extra-large, wide-necked bottles. For writing and drawing on blueprints. The white ink shows snow white without any yellowish tinge.

INKOFF.



No. 3016.

3016. INKOFF (Patented). Draftsman's Outfit, including: one bottle of Inkoff, an assortment of Blotters for absorbing, Cloths for wiping the ink from the Tracing Cloth, and Directions for use. . . . . per outfit $

INK-BOTTLE HOLDERS.



Illustrations about ⅔ size.



No. 3018. 3019.

3018. Ink bottle Holder and Paper weight, iron, enameled, weight about 2 pounds. . . . . each $

The bottle is inserted from below and secured by a bayonet flange; it will hold any of the drawing ink bottles generally used.

3019. Ink-bottle Holder, iron, bronzed, weight about 8 oz., . . . each $

This holder is adapted for either Columbia Inks, (both the square and the round bottle,) or Higgins'. The bottle is held by a steel spring inserted through one of the openings in the sides of the holder: for Columbia Inks through the opening marked C. for Higgins' through that marked H.

The holder is of iron, with a neat bronze finish and shaped to guard against tipping.

CHINESE AND INDIA INKS.

TRADEMARK: K. & E. CO.



No. 3030 N.



3030 N-2.



3031 III.



3031 V.

3030 N. Square, black, gilt figures, Super Super, 3⅜ in. long . . cake $
3030 N-2. " " " " " small, 2⅞ in. long "
3031 III. Oblong, black, 2¾ in. long . . . . . "
3031 V. " " 2¾ " " . . . . . "

Our No. 3031, III, V, India inks are of extra-fine quality; the very finest that are made. As ALL the patterns of fine India inks are imitated in cheap grades and are so minutely copied that it is practically impossible to tell the counterfeit from the genuine by inspection, we mark our extra fine inks with our trademark and initials. This enables the buyer to have our guaranty that the ink is the genuine, fine article and not an imitation.

We highly recommend these fine inks to Draftsmen and Artists.

BRUSHES.

As the quality of brushes cannot be exactly described, and as illustrations cannot be made to show quality, we mention that all the brushes we list are the very best of their respective kind. They are always of the kind of hair indicated without adulteration or substitution, and each size contains the proper quantity of hair. The numbering of the various sizes of our brushes has not been changed in forty years.

Illustrations full size.



3102. Camel Hair, in Quills,

No.	1	2	3	4	5	6	7	8
each $								

BRUSHES.

Illustrations full size.



3112. Camel Hair, in Swan Quills,

No.	0	1	2	3	4	5	6
each $							

BRUSHES.

Illustrations full size.



3120. Black Sable, round, in Albata, black Handle,

No.	1	2	4	6	8	10	12	14	16	18	20	22
each $												

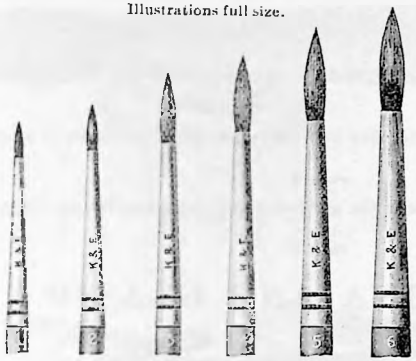
3121. Red Sable, round, in Albata, black Handle,

No.	1	2	4	6	8	10	12	14	16	18	20	22
each $												

Please note that ours are real sable brushes. We emphasize this, because all grades of sable hair, on account of advances in prices, have been extensively adulterated. Real sable brushes form a finer point, retain this point longer than others, and remain elastic.

BRUSHES.

Illustrations full size.

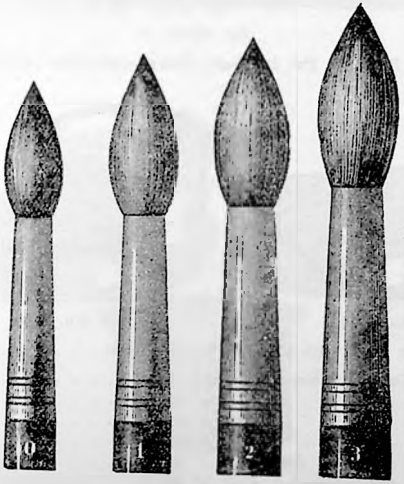


No. 3132.

3132. Camel Hair, in Tin, red Handle,

No.	1	2	3	4	5	6
each $						

Illustrations full size.



No. 3133.

3133. Camel Hair Sky or Wash Brush, in Tin, polished Handle,

No.	0	1	2	3
each $				

Illustration full size.

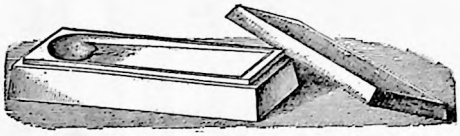


No. 3136-3.

3136. Camel Hair Sky or Wash Brush, extra-fine, round, in Albata,
No. 1 2 3
each $

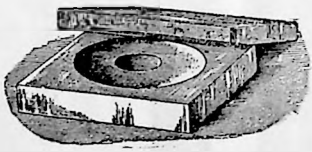
3137. Camel Hair Sky or Wash Brush, extra-fine, flat, in Albata,
No. 1 2 3
each $

CHINA AND GLASSWARE.

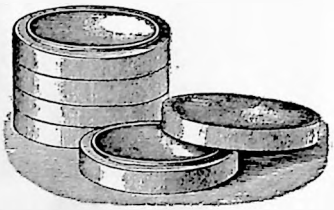


No. 3150.

3150. Keuffel & Esser Co. Pat. Ink Slab, China, with cover, $1\frac{3}{4} \times 4\frac{1}{2}$ in. each $



No. 3154.



No. 3160.

3154. Slate Ink Cup, with glass cover, $3\frac{1}{2} \times 3\frac{1}{2}$ in. . . . . each $

3160. Nest of Cabinet Saucers, 6 in set, $2\frac{3}{8}$ in. . . . . set $

3161. do. 6 " " $2\frac{1}{2}$ " . . . . . "

3162. do. 6 " " $3\frac{1}{4}$ " . . . . . "

3163. do. 6 " " $3\frac{3}{4}$ " . . . . . "

3164. do. deep 4 " " $2\frac{3}{8}$ " . . . . . "

3165. do. " 4 " " $3\frac{1}{4}$ " . . . . . "

3166. do. " 4 " " $3\frac{3}{4}$ " . . . . . "

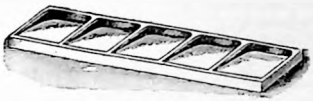
A "Nest of 6" consists of 5 saucers and cover; a "Nest of 4" of 3 saucers and cover.

CHINA AND GLASSWARE.

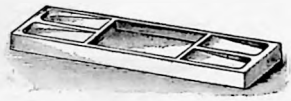


No. 3174.

3174. Ink or Color Slab, 3 Wells, 3 Slopes, $2\frac{1}{2} \times 4$ " . . . . each $
3175. do. 5 " 5 " $4 \times 7\frac{1}{2}$ " . . . . "



No. 3178.



3183.

3176. Sloping Tile, 3 divisions, $2\frac{1}{2} \times 4$ in. . . . . each $
3178. do. 5 " $3 \times 7\frac{3}{4}$ " . . . . . "
3183. Center Slab, 5 divisions, $2\frac{3}{8} \times 6$ " . . . . . "



No. 3184.

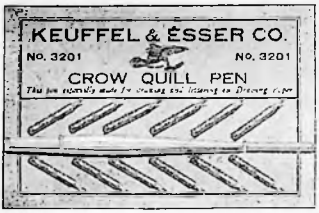
3184. China Color Cups, $2\frac{1}{2}$ 3 in. diam.
each $



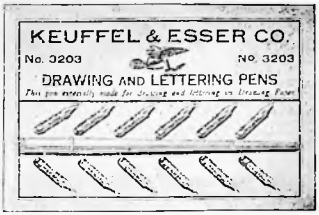
No. 3186.

3186. Artist's Water Glass, $2\frac{3}{8}$ in. diam. . . . . each $
3187. do. $3\frac{1}{4}$ " " . . . . . "

K & E STEEL PENS.



No. 3201.



3203.



No. 3200.

3202.

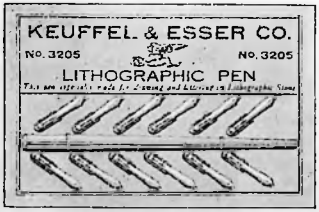
3200. Keuffel & Esser Co. Crow Quill Pens, 1 doz. in a box . . doz. $

3201. Keuffel & Esser Co. Crow Quill Pens, 1 doz. pens No. 3200 and Holder, on a card . . . . . card

3202. Keuffel & Esser Co. Drawing and Lettering Pens, 1 doz. in a box . . . . . doz.

3203. Keuffel & Esser Co. Drawing and Lettering Pens, 1 doz. pens No. 3202 and Holder, on a card . . . . . card

Pens Nos. 3200 and 3202 are specially made for Draftsmen, for drawing and lettering on drawing paper which has a more or less coarse surface. They have longer nibs and less sharp points than most others, possess great elasticity and permit of more rapid lettering or drawing, without scratching or catching in the grain of the paper. Draftsmen will prefer these pens to any other kind, as most others are intended principally for drawing on stone.



No. 3205.

3204. Keuffel & Esser Co. Lithographic Pens, 1 doz. in a box, doz.

3205. Keuffel & Esser Co. Lithographic Pens, 1 doz. pens No. 3204 and Holder, on a card . . . . . card

Pens No. 3204 differ from all other Lithographic Pens in having shorter (and therefore firmer) nibs, and points of the utmost fineness.

K & E STEEL PENS.



No. 3206.



3206. Keuffel & Esser Co. Crow Quill Pens, (No. 3200), in improved Holders with cork finger piece, each $
Card of 10 Pens No. 3206, in improved Holders with cork finger piece . . . . . per card

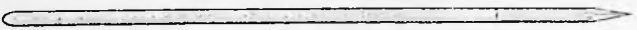
STEEL PENS.

JOSEPH GILLOTT'S.

3210. Lithographic Crow Quill Pens, (No. 659), doz. cards $ card $
3210B. do. do. do. (No. 659B), one gross per box
3211. Superfine long shoulder Crow Quill Pens, (No. 850) . . . . . doz. cards $ card $
3212. Lithographic Pens, (No. 290) . . . . . " " "
3212B. do. do. (No. 290 B), ... one gross per box
3213. Mapping Pens, (No. 291) . . . . . doz. cards $ card $
3213B. do. do. (No. 291B), ... one gross per box
A "card" has 12 pens and 1 holder.
3214. Mapping or Ladies' Pens, (No. 170) . . gross doz.
3215. Lettering Pens, (No. 303) . . . . . " "
3216. do. (No. 404) . . . . . " "

PENS.

FRENCH



No. 3217.

3217. Crow Quill Pens, each with Holder, . . doz. cards $ card $

A "card" has 12 pens, each with holder.

ROAD PENS.



No. 3532. (see page 27).

These pens have two fine equal points and are used as road pens in map drawing.

K & E PENHOLDERS.



No. 3220.

3220. Improved Crow Quill Penholder . . . . . each $



No. 3221

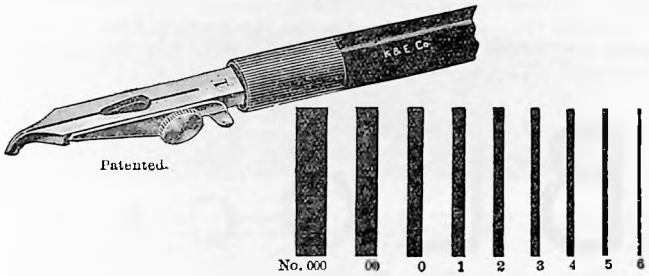
3221. Improved Lettering Penholder . . . . . each $

These holders for crow quill and lettering pens are of the thickness of an ordinary penholder, a great improvement over the thin sticks generally used.

For Round Writing Pens etc., see page 227.

PAYZANT (FREEHAND) LETTERING PENS

with Ink Reservoir.



Patented.

BRASS.

3224. Payzant Lettering Pens, Brass, Nos. 0, 00, 000 . . . . . each $
3224. do. do. Nos. 1, 2, 3, 4, 5, 6 . . . . . "
3225. do. do. Set of six pens,
Nos. 1 to 6, in partitioned paper box . . set

NICKEL SILVER.

3224 S. Payzant Lettering Pens, Nickel Silver, Nos. 1, 2, 3, 4, 5, 6. . . each
3225 S. do. do. Set of six pens,
Nos. 1 to 6, in partitioned paper box . . set

The Payzant Lettering Pens are particularly adapted for lettering Engineers' and Architects' drawings and for the use of Merchants in writing price tags, show cards, etc.

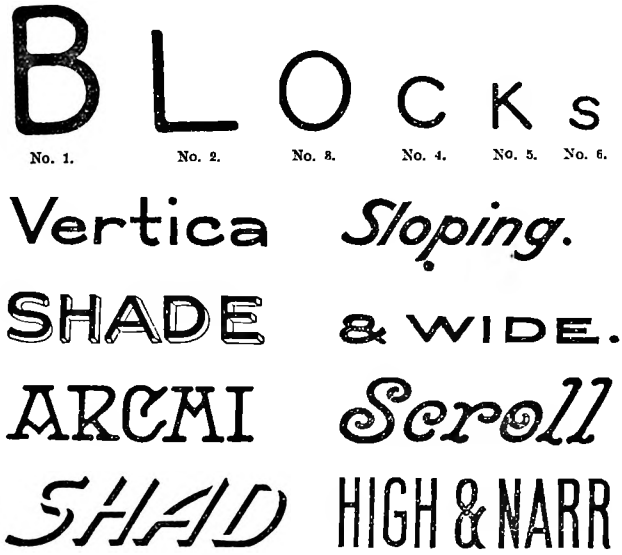
The usual method of forming heavy letters with a fine pen is slow and tedious work and but few draftsmen are capable of executing neat lettering with reasonable rapidity. Therefore, the Payzant Lettering Pens supply a long felt want at the drafting table, as the letters are completely formed in a single stroke in one-quarter of the time needed for outlining and filling in each letter with a fine pen.

There is no knack in acquiring a facile use of these pens, as the marking point is constructed to produce the same gauge of line no matter in what direction the pen is moved over the paper. Owing to the absolute uniformity of the lines in width and density, any draftsman, novice or expert, can do finer and neater lettering with these pens than by the fine-pen method. It is unnecessary, even on the finest plans, to carefully draw the letters in pencil before inking; a rough draft to obtain proper spacing is all that is needed.

The reservoir attachment gives the No. 1 pen a capacity of 100 or more words with each filling of ink; the capacity of the smaller sizes is progressively greater.

For border lines or any heavy line work these pens are far superior to the usual ruling pen, as 25 to 30 feet can easily be ruled without re-filling the reservoir. There are no delicate parts to get out of order and with ordinary care a set of these pens will last a lifetime.

These pens are manufactured in nine graded sizes in brass, and in six graded sizes in nickel silver. We give a few reproductions of letters made with them.



Fac-simile of letters made with Payzant Pens.

Suggestions for using the Payzant Block Lettering Pen:

Fill the pen by quill or dropper, the same as a ruling pen is filled; never dip it into the ink.

After filling, adjust the nibs to the proper feeding distance, and test on scrap paper.

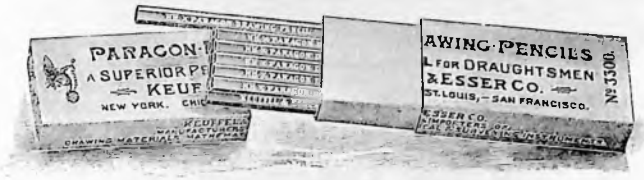
Should the pen become clogged while in use, open the nibs slightly and insert the edge of a piece of paper.

On drawings for which a fine finish is desired, add sharp corners to the letters with a fine pen and shade as required.

After using, open the reservoir (by loosening the clamp screw) and clean thoroughly.

LEAD PENCILS.

KEUFFEL & ESSER CO'S.



Our Paragon Pencils and Colored Pencils are of the very best quality and possess all the merits of other best makes established in this market. They excel in correctness and uniformity of grading, and cost less than other similar pencils. We fully warrant these pencils and ask that they be given a trial.



3300. Paragon Pencils, extra fine quality, hexagon, yellow polish and gilt: 2B, B, HB, F, H, 2H, 3H, 4H, 5H, 6H. . . . . per doz. $

K & E DETAIL PENCILS.



No. 3348.

3348. K. & E. Co. Detail Pencils, hexagon, gilt,
Nos. 2, 3, 4, 5. . . . . gross $ doz. $

We recommend these Detail Pencils as being of excellent quality and carefully graded.

PENCIL HOLDERS.



No. 3349.

3349. Holder for pencil stumps, 4½ in. hexagonal, metal ferrule . each $

PENCILS.



No. 3352.

3352. Eldorado Drawing Pencils, hexagon, gilt.,
Nos. 6 B, 5 B, 4 B, 3 B, BB, B, F, HB, H, HH,
8 H, 4 H, 5 H, 6 H, 7 H, 8 H, 9 H. . . . . doz. $

HARDTMUTH'S KOH-I-NOOR PENCILS.



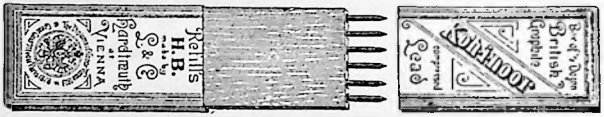
No. 3380.

3380. Koh-i-noor Pencils, hexagon, yellow polish, 6 B, 5 B, 4 B,
3 B, BB, B, F, HB, H, HH, 3 H, 4 H, 5 H, 6 H, 7 H,
8 H, 9 H . . . . . each $
3381. Koh-i-noor Copying Pencils . . . . . "



No. 3383.

3383. Koh-i-noor Artist Pencils, yellow polish, 6 B, 5 B, 4 B,
3 B, BB, B, F, HB, H, HH, 3 H, 4 H, 5 H, 6 H, 7 H,
8 H, 9 H . . . . . each $



No. 3385.

3385. Koh-i-noor leads for Artist Pencils, 6 B, 5 B, 4 B,
3 B, BB, B, F, HB, H, HH, 3 H, 4 H, 5 H, 6 H,
7 H, 8 H, 9 H . . . . . per box of 6 $

MEPHISTO COPYING PENCILS.

3390. Mephisto Copying Pencils (No. 73 B) . . . . . doz. $
3391. do. do. do. (No. 73 B hard) . . . . . "
3392. do. do. do. with red tip (No. 77) . . . . . "

A. W. FABER'S CASTELL POLYCHROMOS COLORED PENCILS.



3395. A. W. Faber's Polychromos Pencils . . . . doz. $ each $

3395 is old No. 3375.

No.	1.	White,	No.	9.	Orange,
"	4.	Light chrome,	"	14.	Green bice.
"	24.	Ultramarine,	"	17.	Hooker's green No. 2,
"	49.	Indian red,	"	32.	Madder Carmine,
"	38.	Pale vermilion,	"	21.	Light blue,
"	29.	Red violet lake,	"	60.	Ivory black.

DIXON'S COLORED PENCILS.



3397. Dixon's Colored Pencils,

No.	352.	White,	No.	351.	Terra Cotta,
"	322.	Pink,	"	343.	Brown,
"	321½.	Lake red,	"	331.	Black,
"	349.	Red,	"	353.	Golden yellow,
"	324.	Orange,	"	354.	Green,
"	325.	Olive green,	"	320.	Sky blue,
"	350.	Blue,	"	330.	Indigo blue.



3398. Dixon's Colored Pencils, in boxes,
box of 7 12 assorted colors.
per box $

LUMBER CRAYONS.



No. N 8405.

N3404. "Favorite" Lumber Crayons.

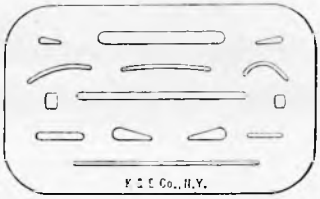
N 3404 is old No. 3405 B.

Black . . . . . per dozen $
Blue . . . . . " "
Red . . . . . " "

N3405. Dixon's Colored Crayons, 4½×½ in., paper covered, Yellow, Terra Cotta, Red, Blue, Green . . . . . doz. $

N 3405 is old No. 3405 A.

ERASING SHIELDS.

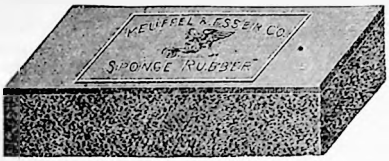


No. 3410.

3410. Nickel silver Erasing Shield for Draftsmen, $2\frac{3}{8} \times 2\frac{3}{4}$ in. . . each $
3411. Steel do. . . . . $2\frac{3}{8} \times 2\frac{3}{4}$ " . . "
3412. Xylonite do. nickelplated $2\frac{3}{8} \times 3\frac{1}{4}$ " . . "

SPONGE RUBBER

for Cleaning Drawings.



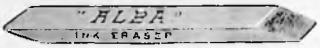
No. 3414½.

3414. Sponge Rubber, with solid back, $1 \times 1 \times 1$ in. . . . . each $
3414½. do. " " " $2\frac{1}{2} \times 1\frac{3}{4} \times \frac{5}{8}$ " . . . . "

3414 is old No 3406;
3414½ is old No. 3407.

ALBA RUBBER.

The ALBA is a high-grade eraser, of smooth finish and exceptional purity. It takes hold readily, will not smudge nor stain the paper and retains its excellent qualities for a long time.



No. 3418.

3418. Alba Ink Eraser, oblong, $2\frac{1}{2} \times \frac{1}{4} \times \frac{1}{4}$ in. . . . . per cake $
3419. do. " $3\frac{1}{4} \times \frac{5}{8} \times \frac{5}{8}$ " . . . . . " "

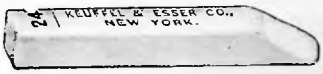
K & E PLIABLE RUBBER.



No. 3452.

3452. Pliable Rubber, gray, flat, per cake $	24	20	12	8 to lb.

EMERALD AND RUBY RUBBER.





		No. 3455 G.				
3455 G.	Emerald Rubber, oblong, wedge edge, per cake $	48	36	24	20	12 to lb.
3455 R.	Ruby Rubber, oblong, wedge edge, per cake $	48	36	24	20	12 to lb.

E. FABER'S ERASERS.





3456 G-1. Emerald Eraser, No. 111. medium . . . . . each $
3456 G-2. do. do. " 211. large . . . . . "
3456 R-1. Ruby Eraser, No. 112. medium . . . . . "
3456 R-2. do. do. " 212. large . . . . . "





3457. Soft Ink Eraser, No. 6500. . . . . each $
3458-1. Ink and Pencil Eraser, No. 110. medium . . . . . "
3458-2. do. do. do. " 210. large . . . . . "
3459. Typewriter Eraser, No. 1080 B. . . . . "



3460 A. Art Gum, $1\frac{1}{4} \times 1\frac{1}{8} \times 1\frac{1}{8}$ in. . . . . each $
3460 B. do. do. $2 \times 1 \times 1$ " . . . . . "
3460 C. do. do. $2\frac{1}{4} \times 1\frac{1}{4} \times 1\frac{1}{4}$ " . . . . . "
3460 D. do. do. $3 \times 2 \times 1$ " . . . . . "
3460 E. do. do. $3 \times 3 \times 2$ " . . . . . "

STEEL ERASERS.



No. 3480.

3480. Steel Eraser with long blade, Bone Handle, Domestic . . each $
3481. do. " " " Coco " " . . "



No. 3486.

3485. Steel Eraser with short blade, Bone Handle, Domestic . . each $
3486. do. " " " Coco " " "

LEAD PENCIL FILE.



No. 3488.

3488. Lead Pencil File and Tack Lifter, 6 in. . . . . each $

A convenient little tool, consisting of a steel file with a steel tack lifter at the end, black wooden handle.

PENCIL POINTERS.

These Pencil Pointers consist of 12 sheets made into a block.



Nos. 3507 and 3508.

Flint Paper

3507. Pencil Pointer with wooden handle, $1\frac{1}{4} \times 4$ in. . . . . each $

Emery Paper

3508. Pencil Pointer with wooden handle, like No. 3507 but of emery paper, $1\frac{1}{4} \times 4$ in. . . . . "

PENCIL SHARPENERS.



No. 3511.

3511. "Useful" Pencil Pointer and Paper Weight, iron, enameled, about 1½ lbs. . . . . each $

The Useful Pencil Sharpener is a roller covered with flint paper and mounted in a heavy metal box with cloth-lined bottom. The roller has eight faces and, therefore, will last a long time. The box catches the debris, and is heavy enough to require no holding when sharpening a pencil while the other hand is engaged. It is also a good paper weight. With each pencil pointer we furnish 2 extra sandpaper coverings for the roller.



No. 3517.



Showing lead exposed when No. N 3518 is used.

3517. Dexter Pencil Sharpener, ... each $

N3518. Dexter Pencil Sharpener fitted with draftsman's special cutters . . . . . "

These cutters of N 3518 take off wood only, leaving lead exposed; lead may be pointed on file or sandpaper to suit requirements.

The Dexter is the most satisfactory hand feed pencil sharpener that can be produced. The twin milling cutters are made of the best tool steel for the cutting of graphite, a guarantee of long service. This machine sharpens all sizes of pencils, and has a point adjuster which enables the user to produce any desired point from blunt to fine. When the pencil is thoroughly sharpened the cutters no longer function, which feature necessarily makes for considerable saving in pencil expense.

The frame is of steel, heavily nickelplated and highly polished. Transparent shaving receptacle adjusts itself to any position, consequently the sharpener can be suspended from above, placed on the wall, or fastened to desk or table. This machine is of the highest grade workmanship and is beautifully finished.

Round Writing

F. SOENNECKEN'S system of ornamental writing, called Round Writing, hardly needs any recommendation on our part.

The Methodical Text-Book for self-instruction is a complete guide for acquiring this beautiful hand in a very short time (ten to fourteen lessons suffice for a complete course in schools). There is scarcely any profession or business but could advantageously make use of this writing in many ways.

It enables Engineers, Architects and Draftsmen to letter drawings, maps, etc., in Round Writing, elegantly and quickly.

Bankers and Merchants will find it most valuable and appropriate in heading books, filling out check blanks, price lists, etc., etc.

Insurance Companies and Lawyers cannot use more distinct letters for filling out or writing policies and legal documents.

Storekeepers can write neat show cards or price tags in this hand.

IN ORDER TO LEARN ROUND WRITING

it is **indispensable** to thoroughly study and strictly observe the directions given in the

METHODICAL TEXT BOOK

especially with respect to the holding of the pen and to the exercises in writing.

The book plainly shows the scientific principles on which this Writing System is based; all efforts to master it by using the pens without the Text Book will be unsuccessful, and a vain waste of time and labor. Correct and artistic execution of the characters does not depend on

ADROITNESS OF HAND,

as may be the general impression, but merely on the thorough knowledge of the manner of holding the pen and of the system of the characters as exhibited in the

METHODICAL TEXT BOOK.

3520. Methodical Text-Book to Round Writing by F. Soennecken, (published by Keuffel & Esser Co., New York) including an assortment of 25 single and double-pointed pens. . . . each $

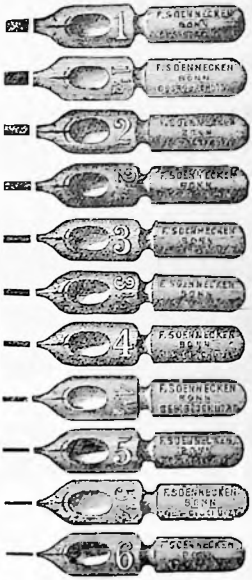
3521. do. do. do. Book without pens . . . . . "

3522. do. do. do. do. bound in cloth, with an assortment of 25 pens . . . . . "

3523. Copy Book without Instructions (School Ed.) including an assortment of 25 single and double-pointed pens . . . . . "

3524. do. do. do. Book without pens . . . . . "

ROUND WRITING PENS.



No. 3530.



No. 3534.



No. 3532.



No. 3535.

3530. Single Pointed Pens, Nos. 1, 1½, 2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, any one number . . . . . per gross $

3531. do. do. do. do. . . . . " ¼ "

3532. Double-Pointed Pens, Nos. 10, 20, 30, 40, 50, 60, 70, 80, 90, any one number . . . . . " ¼ "
" doz.

3533. Sample Assortment of Single and Double-Pointed Pens, with Inkholder, 25 in a box . . . . . $

3534. Three-Pointed Pen, for ornamental work, ... each $

3535. Inkholder for single-pointed Pens, especially adapted for writing with India or Autograph Ink, per box of 6 $



3560. Penholder for Round Writing Pens . . . . . each $



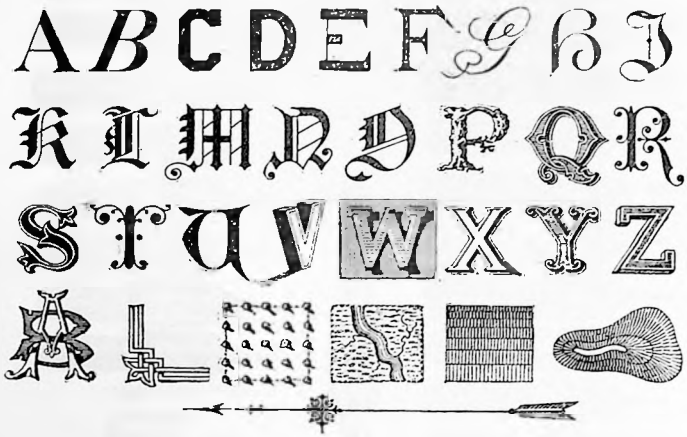
3561. Double Penholder for Round Writing Pens . . . . . each $

Each gross or quarter-gross box contains Pens of one number only.

DRAFTSMAN'S ALPHABETS

BY

KEUFFEL & ESSER CO.



3570. Draftsman's Alphabets, cloth bound, board cover with gilt imprint, size 7 × 10½ in. . . . . each $

The above cut shows reduced specimens of our "Draftsman's Alphabet", which gives on 31 pages a large variety of Alphabets, Numbers, Topographical Signs, etc. It will be found most useful to draftsmen as the selection is made with great care, and the letters are engraved with reference to practical use, so that each letter, number or sign may be copied without difficulty.

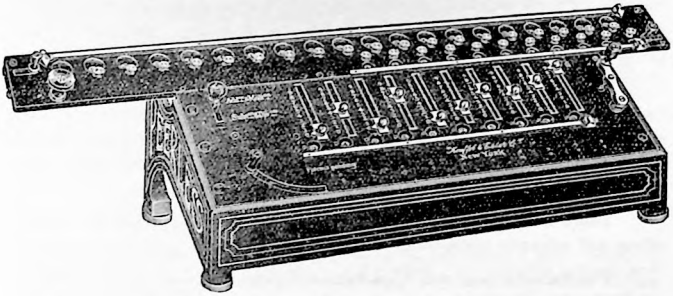


3571. Students' Alphabets, a selection of the most useful alphabets from above book, paper cover . . . . . each $

THE IMPROVED

RECKONING MACHINE.

A PERFECT MECHANICAL CALCULATOR.



No. 4007.

4005. Reckoning Machine, 6 figures for Multiplicand or Divisor, 7 figures for Multiplier or Quotient, 12 figures for Product or Dividend; with Directions . . . . . each $

4006. do. do. 8 figures for Multiplicand or Divisor, 9 figures for Multiplier or Quotient, 16 figures for Product or Dividend; with Directions . . . . . each $

4007. do. do. 10 figures for Multiplicand or Divisor, 11 figures for Multiplier or Quotient, 20 figures for Product or Dividend; with Directions . . . . . each $

The K & E Improved Reckoning Machines which we now offer, represent the most advanced progress in the art of making mechanical calculators. They embody the latest improvements, which fact considerably increases their value as savers of time and mental drudgery, and is a guarantee of accuracy. They are perfect instruments, both mechanically and in their functions.

Send us your machines for repairs. Estimates cheerfully submitted.

Any arithmetical problem

from multiplication, division, simple addition and subtraction to the most intricate calculations, can be solved with this instrument, without mental effort, and with unfailing accuracy and surprising rapidity.

The tiresome mental labor of calculating in the ordinary way, is reduced by the Reckoning Machine to a simple jotting down of the results obtained.

Squaring, Cubing, Extracting square roots, Percentage, Conversion of moneys, weights and mensures, Prorating, any kind of Commercial, Statistical, or Scientific calculation can be done by the Reckoning Machine with the greatest precision and extreme rapidity.

The Machine is built in the most substantial manner so that it will retain its efficiency and accuracy for a very long time. It is supported at a convenient working angle on a metal frame, which is open at the sides and back, and is provided with rubber bumpers to reduce the noise of the mechanism. The wooden cover and the wooden base are not shown in the cut.

There are a good many of these Machines in use in public and private offices and scientific laboratories, and they are giving the greatest satisfaction.

The valuable patented improvements which we have recently added to our Reckoning Machines are:

The new cancelling device, which at one shift of the handle sets all the keys in the grooves of the key plate back to zero, thus saving the time lost in moving each key to the zero position separately.

A line of windows below the grooves of the key plate, in which the settings of the several keys are indicated by figures, so that on our Machines, the two factors of a calculation and their product each appear in one straight line of figures. This feature is a safeguard against error in reading the settings of the keys, which otherwise often present a very irregular line.

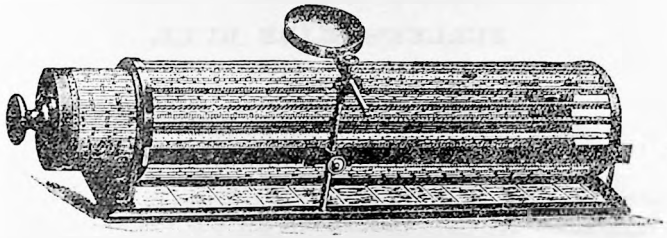
Decimal pointers, arranged to slide on bars so that they may be set quickly and permanently wherever a decimal point is to be indicated. This device will be found much handier and safer than the old method of using pegs, which are inconvenient to handle, liable to drop out, and easily lost.

Additional safety devices in connection with the tens-carrying mechanism, eliminate the possibility of "sticking", or error in the rapid operation of the machine.

A book containing a full description, all the necessary rules for operating, and numerous examples, both general and special, accompanies each one of our Reckoning Machines.

KEUFFEL & ESSER CO. NEW YORK

THACHER'S
CALCULATING INSTRUMENT.



No. 4013.

4012. Thacher's Calculating Instrument, cylinder 18 in.; in polished mahogany Box, with full Directions . . . . each $

4013. do. do. do. with 3-in. reading glass sliding on brass bar, adjustable to any part of the instrument and for focus . . . . . "
Extra copy of directions . . . . . "

Thacher's Calculating Instrument is a device for performing a great variety of useful arithmetical calculations with rapidity and accuracy. Its operation is simple and is readily learned. By its use the tedious drudgery of calculation is avoided and the chance of error eliminated.

As is shown in the illustration, the instrument consists of a cylinder 4 in. in diam. and 18 in. long, which revolves in an open framework composed of 20 angular bars held between two metal rings. The cylinder bears a scale corresponding to the scale of the Slide Rule, which is duplicated on the exposed sides of the bars. Results can be obtained to the fourth, and usually to the fifth place of figures, with a surprising degree of accuracy, sufficient for nearly every requirement of the professional or business man. Examples in multiplication, division, proportion and powers or roots involving not more than three quantities, are solved by one operation and any number of values of an algebraic function composed of two constants and a single variable may generally be found by one setting.

The useful applications of the instrument are almost unlimited; among them may be mentioned: finding the stresses and sections in trusses and girders, mensuration, estimates of work and material, solving trigonometrical formulæ, making and applying tables, problems in mechanical powers, machinery and hydraulics, problems in simple and compound interest, discount, prorating, the conversion of weights and measures, cost of merchandise with per cent. of duty or profit added.

For example, any of the formulæ

$$\frac{ax}{b}\ ,\quad \frac{ax^2}{b}\ ,\quad \frac{ax}{b^2}\ ,\quad \frac{ax^2}{b^2}\ ,\quad \sqrt{\frac{ax}{b}}\ ,\quad \sqrt{\frac{a^2x}{b}}$$

in which a and b may have any values and x any number of values, are readily solved by one setting. Squares, square roots, cube roots and reciprocals are also readily worked.

The following are a few problems which may be readily solved by the use of Thacher's Calculating Instrument:

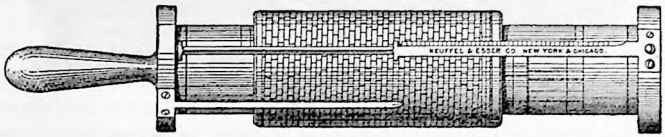
A 15-in. "I" beam, resting upon supports 14.5 ft. apart sustains a load of 17500 lbs. at the center. What weight of beam is required if S = 10000 lbs. per sq. in.? (This problem is solved in three settings of the instrument.)

$341.36 are to be divided prorata among various accounts amounting to $7436.00. Required, the amount, going to account of $427.50, $763.80, etc. (The several amounts are each found in one setting.)

A train weighing 2500 lbs. per lineal foot passes over a bridge on a 4° curve at a speed of 30 miles an hour; required, its effect upon the lateral system. (This problem is solved in one setting.)

What will be the amount of $250.00 placed at compound interest for 10 years at 6%? (This problem is solved in one setting.)

FULLER'S SLIDE RULE.



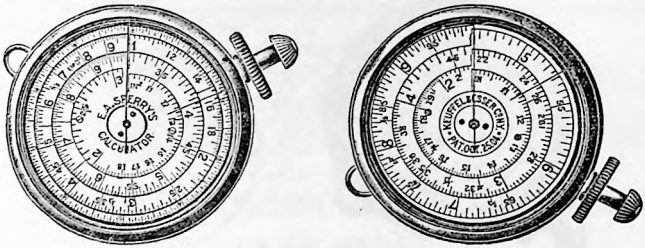
No. 4015.

4015. Fuller's Spiral Slide Rule, in mahogany Box, with Directions . . . . . each $

Fuller's Spiral Slide Rule consists of a hollow cylinder which can be moved up, down, or around an inner cylinder provided with a handle. A single logarithmic scale, nearly 42 feet long, is wound spirally around the outer cylinder. There are two indexes: a fixed one attached to the handle, and a movable one attached to a brass tube sliding in the inner cylinder. This latter bears two indexes (whose distance apart is the axial length of the complete spiral) and a scale of equal parts for the rapid finding of logarithms. On the inner cylinder, there are a number of valuable tables and settings.

Ratios are established by setting a given number to the fixed index, setting the movable index to another given number, bringing any other number to the fixed index, and reading the fourth term at the movable index. Hence the Fuller Rule requires setting each time the third term of a proportion changes, and it does not give a complete series of equal ratios at sight, like the Thacher, Mannheim and Polyphase Duplex Rules. We furnish a holder which can be screwed on to a table to support the rule.

SPERRY'S POCKET CALCULATORS.



S dial No. 4017. L dial

4017. Sperry's Pocket Calculator, watch pattern, 2⅛ in. diam., two glass covered, engraved, metal dials, with Directions. . . . . each $3

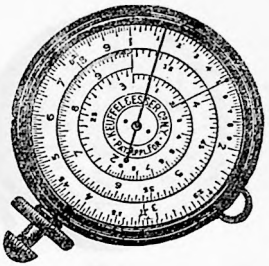
Sperry's Pocket Calculator represents a new departure in pocket calculators, as by its construction the length of the logarithmic scale is increased from about 6¾ in. (in other calculators) to an actual length of about 12½ inches which, however, owing to the arrangement of the scales, allows of reading results nearly as close as on the C D scales of a 20-in. straight slide rule. The instrument has the form of a watch, with an engraved, glass-covered metal dial on each side. Each dial has an index hand and a stationary pointer, which together take the place of the indicator (runner) of a straight slide rule. There is a small ring on the case for attaching the instrument to the watch chain. The two dials are revolved together by a milled thumbnut which is concentric with the knob which revolves the two indexes (hands) together.

The S dial bears a scale of equal parts, a circular logarithmic scale, and a scale of square roots. It corresponds to the two outer scales and the scale of equal parts of the straight slide rule. The L dial bears a logarithmic scale arranged in three spiral rings beginning and ending on the same radial line.

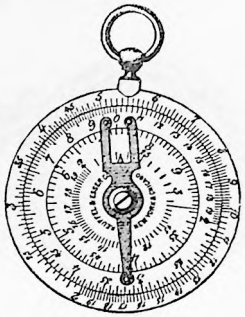
Sperry's Pocket Calculator can neither warp nor shrink as it is entirely of metal. The scales are circular and are, therefore, practically endless, so that they can be used "around and around," each "re-set" multiplying or dividing the value of the reading without loss of time or interruption. The result never lies beyond the end of the scales as it sometimes does in the straight slide rule.

K & E CIRCULAR CALCULATORS.

CHARPENTIER CALCULATORS.



No. 4018.



4020.

4018. K & E Calculator, patented, watch pattern, 2⅛ in. diam., two glass covered, engraved, metal dials, with Directions, each $

The K & E Calculator is practically a circular Mannheim Rule. It has two dials, one of them revolving, the other stationary.

The revolving dial has a scale of logarithmic numbers corresponding to the C D scales of the straight Mannheim rule, and a scale of squares corresponding to the A B scales of the straight rule. There is a reading line (index) engraved on the glass of the movable dial.

The stationary dial has a scale of tangents, scale of equal parts, and a scale of sines, the latter on a two-turn spiral line.

The pointers (hands) of the two dials move simultaneously. The movable dial and the pointers are revolved respectively, by a concentric thumb nut and knob. There is a small ring on the case for attaching the instrument to the watch chain.

This form of Mannheim rule has an advantage over the straight rule in that the scales are practically endless, so that they can be used "around and around," each "re-set" multiplying or dividing the value of the readings without loss of time or interruption. The result never lies beyond the end of the scale, as it sometimes does in the straight slide rule.

4020. Charpentier Calculator . . . . . each $

The Charpentier Calculator is a circular slide rule 2⅝ in. diameter, with a circular slide which is revolved and set by the handle. This instrument being made of metal is but slightly affected by atmospheric variations. On the face of the calculator (shown in cut) there is a logarithmic scale on the slide corresponding to another scale, external to it on the body of the rule. On the surface within the slide are the square roots in two circles, one from 0 to 3.162, the other from 3.162 to 10. These are made to coincide with the outermost scale by means of an index. On the other side of the rule there are three scales; an outer one of equal parts and two inner ones of angles from 0 to 90 and from 0 to 45 respectively; the latter two give the sines of the first and the tangents of the second on the scale of equal parts, by means of an index. The indexes on the two faces correspond, so that the logarithms of the numbers on the logarithmic scale can be read on the scale of equal parts.

K & E SLIDE RULES.

The Slide Rule in its present perfected form has become an indispensable aid not only to the engineer and scientist, but also to the manufacturer, the merchant, accountant, and all others whose occupation or business involves calculations.

We manufacture slide rules and devote to them a separate department of our factory which is thoroughly equipped with the most improved special machinery.

Several of our improvements are protected by patents, and are, therefore, not embodied in other Rules.

MANNHEIM STYLE OF SLIDE RULES.

This form of slide rule was originated by Lieut. Mannheim. The lower scales (on the rule and on the slide) are single while the two upper scales are double. There is an indicator (runner) for finding coinciding points on the scales, which admits of working out extensive calculations without taking intermediate readings.

On the under face of the slide are scales of sines, tangents and equal parts. The index mark on the under side of the body of the rule permits of reading the scales on the under face of the slide without reversing it. The under surface of the rule has tables giving a number of settings and ratios.

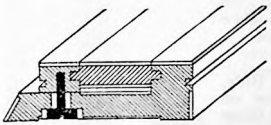
DUPLEX STYLE OF SLIDE RULES.

In the "DUPLEX" SLIDE RULES the slide is of the same thickness as the rule and has its two faces flush with those of the rule. The rule and slide are fully graduated on both sides.

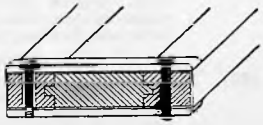
K & E SLIDE ADJUSTMENT.

It is well known that the materials of which most slide rules are made, (wood, xylonite or celluloid) are affected by atmospheric changes incidental to the different seasons, notwithstanding previous treatment or seasoning. Even in the best rules, except those of metal, the slide is liable to work too tight or too loose from such changes in constituent materials. Various means have been devised to overcome this condition but each of them has some serious drawback. A number of so-called automatic adjustments have been devised but none have proved to be practical in use. In those in which the base or stock is cut length-wise into halves which are held together by springs, there is danger of their shrinking unevenly, and they do not afford a rigid bed for the slide. In those which have springs to hold one edge of the slide against the rule, there is a corresponding gap at the other edge of the slide.

K & E SLIDE ADJUSTMENT.



Mannheim Rules.



Duplex-type Rules.

Cross section of K & E Slide Rules showing Slide Adjustment.

The K & E Slide Adjustment has successfully overcome these various drawbacks and solves the problem perfectly. In the Mannheim Rules, one of the grooved guide pieces in which the slide moves is kept in place by setscrews which hold it rigidly but still permit of quick and exact adjustment when these screws are released, as they pass through oblong slots giving ample play. If adjusting should become necessary, it is effected by loosening the screws and bringing the movable guide piece against the slide, according to the friction desired, when the screws are again tightened.

In the Duplex-Type Slide Rule, the nickel silver bars which join the two side bars of the rule are provided with setscrews moving in slots. On releasing these screws, one side piece of the rule can be shifted towards or away from the slide, to obtain the desired friction; it is clamped into place by tightening the setscrews.

Numbering of Slide Rules.

Great care has been bestowed on the numbering of our Rules to make them as clear, distinct, and as permanent as possible. We prefer not to number the subdivisions throughout, as is done on some of the printed rules. The sub numbers are not required by the adept; they are confusing and interfere with rapid and accurate reading. Should they be desired for any special purpose, *we will put them on without extra charge.*

MANNHEIM SLIDE RULES,

K & E ADJUSTABLE.

5-INCH RULE.

4031. K & E Adjustable (Mannheim) Slide Rule, 5-in., engine divided, divisions on white facings, with "Frameless" Glass Indicator; in sewed Leather Case, with Directions . . . . . each $

This rule is subdivided as closely as the 10-in. rule, No. 4041.

8-INCH RULE.

4035. K & E Adjustable (Mannheim) Slide Rule, 8-in., engine divided, divisions on white facings, with "Frameless" Glass Indicator; in sewed Leather Case, with Directions . . . . . "

This rule is subdivided as closely as the 10-inch rule, No. 4041.

10-INCH RULE.

4041. K & E Adjustable (Mannheim) Slide Rule, 10-in., engine divided, divisions on white facings, with "Frameless" Glass Indicator; in Case, with Directions. . . . . "

4041 F. K & E Adjustable (Mannheim) Slide Rule, like 4041, but subdivided as closely as the 20-in. rule . . . . . "

16-INCH RULE.

4045. K & E Adjustable (Mannheim) Slide Rule, 16-in., engine divided, divisions on white facings, with "Frameless" Glass Indicator; in Case, with Directions . . "

20-INCH RULE.

4051. K & E Adjustable (Mannheim) Slide Rule, 20-in., engine divided, divisions on white facings, with "Frameless" Glass Indicator; in Case, with Directions . . "

Rules 4041 F., 4045 and 4051 are divided more closely than the others. They have from 200 to 50 subdivisions between the prime numbers, while the other rules have from 100 to 20, so that reading is closer by at least one figure.

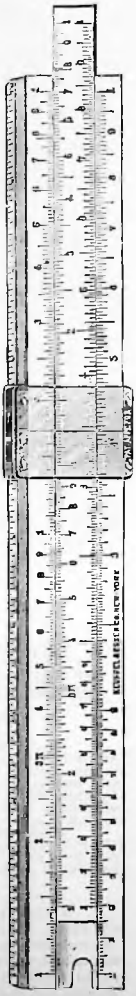
4052 D. L. "Frameless" Glass Indicator, with two Hairlines (instead of one) . extra "

do. do. but with the two Hairlines spaced to a stated ratio . . . extra "

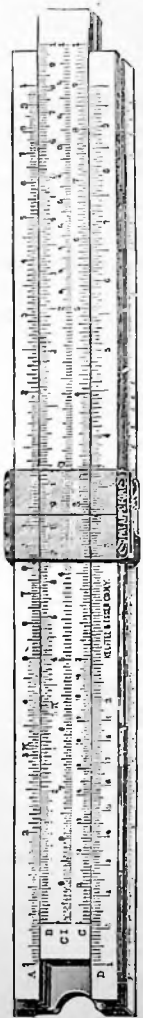
(For Indicator with Decimal Pointer, see No. 4080, page 247.)

For Magnifiers and Books on the Slide Rule, see page 247.

For Leather Cases, see page 238.



No. 4041.



No. 4053-3.

POLYPHASE SLIDE RULES,

MANNHEIM TYPE

K & E ADJUSTABLE.

The Polyphase Slide Rule has, in addition to the regular scales of the Mannheim, a scale of cubes on the vertical edge of the rule and an inverted scale (CI) on the face of the slide, which scales may readily be used in conjunction with the other scales, by means of the indicator. This arrangement combines some of the features of the Duplex Rule with the regular Mannheim type.

The inverted scale enables the operator to take three factors at one setting of the slide, and to read reciprocals by means of the indicator. Such expressions as

$$\sqrt{a^3} \quad ; \quad \sqrt[3]{a^2} \quad ; \quad \sqrt[3]{\frac{1}{a^2}},$$

$$a^5 \; ; \; a^6 \; ; \; a^7 \; ; \; \sqrt{a^2} \; ; \; \sqrt[3]{a^2} \; ;$$

$$\sqrt[4]{a^2} \quad ; \quad \sqrt{a^4} \quad ; \quad \sqrt{\frac{a}{b^2}} \; ;$$

$$a^2 \times \sqrt[3]{b^2} \quad ; \quad \sqrt{\frac{a^3 \times b^3}{c^3}}$$

may be read by means of the indicator, and almost any combination of three factors involving square, square root, cube and cube root, may be solved at one setting of the slide.

8-INCH RULE.

4053-2. Polyphase (Mannheim) Slide Rule, K & E Adjustable, 8 in., engine divided, divisions on white facings, "Frameless" Glass Indicator; in sewed Leather Case, with Directions . . . . . each $

10-INCH RULES.

4053-3. Polyphase (Mannheim) Slide Rule, K & E Adjustable, 10 in., engine divided, divisions on white facings, "Frameless" Glass Indicator; in Case, with Directions . . . . . "

4053-3F. Polyphase (Mannheim) Slide Rule, like No. 4053-3, 10 in., but subdivided as closely as the 20-in. rule . . . . . "

20-INCH RULE.

4053-5. Polyphase (Mannheim) Slide Rule, K & E Adjustable, 20-in., engine divided, divisions on white facings, "Frameless" Glass Indicator; in Case, with Directions . . . . . "

For Magnifiers and Books on the Slide Rule, see page 247.

For Leather Cases, see page 238.

FAVORITE SLIDE RULES.

MANNHEIM TYPE.



No. 4054.

4054. Favorite (Mannheim) Slide Rule, 10 in., divided on white facings, with glass Indicator; in Case, with Directions . each $

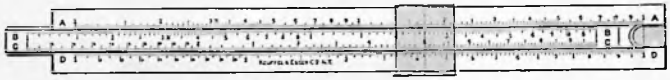
4056. Favorite (Mannheim) Slide Rule, 10 in., polished boxwood, with glass Indicator; in Case, with Directions . . . . "

FOR SUB NUMBERING, SEE PAGE 236.

The Favorite Slide Rules are of the same pattern as No. 4041, but they are not adjustable. They are an improvement over the imported rules, being made of materials seasoned here and, therefore, less liable to warp or shrink.

For Magnifiers and Books on the Slide Rule, see page 247.

STUDENT'S SLIDE RULE.



No. 4058.

4058. Student's Slide Rule, (Mannheim), 10 in., transparent Xylonite Indicator, with steel spring, with Directions . . . each $

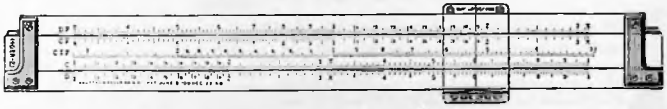
The Student's Slide Rule is intended only for the use of beginners to enable them to become familiar with the slide rule without incurring the expense of obtaining the regular rule.

It is similar to our Mannheim Slide Rule. The graduations are printed on light-colored wood, and plain Directions are furnished with each rule.

CASES FOR SLIDE RULES.

Case for			10	16	20 in. rule
		each $			
Sewed leather Case for	5	8	10	16	20 in. rule
	each $				
Sewed leather Case, with space for Magnifier No. 4085,					
	for 5	8	10	16	20 in. rule
	each $				

POLYPHASE DUPLEX SLIDE RULES, K & E ADJUSTABLE.



No. 4088-2 (front) fig. 1.



No. 4088-2 (back) fig. 2.

4088-2. Polyphase Duplex Slide Rule, K & E Adjustable, 8 in., engine divided, divisions on white facings, "Frameless" Glass Indicator; in sewed Leather Case, with Directions . . . . . each $

4088-3. Polyphase Duplex Slide Rule, K & E Adjustable, 10 in., engine divided, divisions on white facings, "Frameless" Glass Indicator; in Case, with Directions . . . . . "

4088-5. Polyphase Duplex Slide Rule, K & E Adjustable, 20 in., engine divided, divisions on white facings, "Frameless" Glass Indicator; in Case, with Directions . . . . . "

The Polyphase Duplex Slide Rule is a combination of the Polyphase and the Duplex Rules, with the addition of several special scales. It is very valuable for the solution of problems involving exponentials, reciprocals and extended combinations of factors. Involved computations may be performed with a minimum number of settings, decreasing the possibility of error in reading, and reducing the time required to perform calculations. Any one of the scales may be read in connection with any other one by means of the indicator which encircles the rule.

In introducing the various changes and innovations enumerated, great care has been exercised to avoid complicating the rule, so that the Polyphase Duplex Rule can be used efficiently for the simpler problems of multiplication and division as well as for the more complicated operations encountered in the solution of various empirical formulæ.

The Polyphase Duplex is of the same pattern as the Duplex Rule, being graduated on both sides, and has our slide adjustment.

On one face (fig. 1) are the following scales:

- DF, a full length D scale, folded. (The graduations begin and end approximately at the center of the rule, the scales being so placed as to bring the division 3.1416 (π) in line with both indexes of the lower D scale.)
- CF, a full length C scale, folded like the DF scale.
- CIF, a full length inverted folded C scale on the center line of the slide.
- C, a full length regular C scale.
- D, a full length regular D scale.

On the other face of the rule (fig. 2) are the following scales:

- K, a scale consisting of three complete logarithmic scales. (Used in connection with the D scale for cubes and cube roots.)
- A, two complete logarithmic scales (used in connection with the D scale for squares and square roots).
- S and T, the usual trigonometrical scales of sines and tangents.
- CI, a full length C scale inverted.
- D, a full length regular D scale.
- L, a scale of equal parts (for finding logarithms of numbers).

LOG LOG DUPLEX SLIDE RULE,

K & E ADJUSTABLE.



No. 4092.

4092. Log Log Duplex Slide Rule, K & E Adjustable, 10 in., engine divided, divisions on white facings, "Frameless" Glass Indicator; in Case, with Directions . . . . . each $

The Log Log Duplex Slide Rule has, in addition to the scales of the regular Duplex slide rule, a Log Log scale, three fold, graduated from 1.01 to 22000, with which any root or power of any quantity up to 22000, may be determined by direct operation at one setting of the slide.

Exponentials generally, and the many formulæ in electrical and mechanical engineering involving fractional powers or roots, hyperbolic logarithms, etc., are readily handled with the help of this scale.

The hyperbolic or natural logarithm of a quantity with its characteristic may be read by means of the indicator without setting the slide, or may be used directly as a factor when required in any formula.

The scales are arranged as follows:

On the front face are the regular A, B, C and D scales, and a scale of sines, in the usual order.

On the reverse face there are, in the order named:

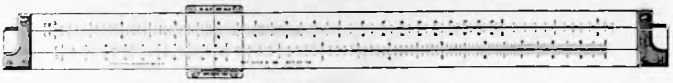
Log Log scale, in three parts,
The C scale,
The scale of tangents,
The CI scale (C Inverted),
The D scale,
The scale of equal parts.

By the arrangement of the C and CI scales on the slide with the scale of tangents between, the tangent or co-tangent of any angle from 5° 43′ to 84° 17′ can be read on the slide, or used as a factor if so required.

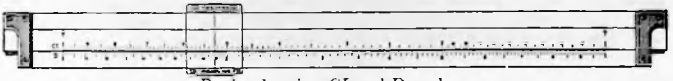
For Magnifiers and Books on the Slide Rule, see page 247.

For Leather Cases, see page 238.

MERCHANT'S SLIDE RULE, K & E ADJUSTABLE.



Front, showing DF, CF, C and D scales.



Back, showing CI and D scales.

4095. Merchant's Slide Rule, K & E Adjustable, 10 in., Duplex Type, engine divided, divisions on white facings, K & E "Frameless" Indicator; in Case, with Directions, ... each $

Especially designed for the merchant, importer, exporter, accountant, manager, mechanic, foreman, etc. By means of it, all manner of problems involving multiplication, division and proportion can be correctly solved without mental strain and in a small fraction of the time required to work them out by the usual "figuring".

For instance, rapid calculation is made possible of such problems as the following, which are of every day occurrence in office and shop: Discounts, simple and compound interest, pro-rating, converting feet into meters, pounds into kilograms, foreign moneys into U. S. money, taking of a series of discounts from list prices, adding profit to costs, while dozens of equivalents are instantly shown, such as: cubic inches or feet in gallons, and vice versa; centimeters in inches, inches in yards, or feet; kilometers in miles, square centimeters in square inches, litres in cubic feet, kilograms in pounds; pounds in gallons; feet per second in miles per hour; circumference and diameter of circles.

STADIA SLIDE RULES, K & E ADJUSTABLE.



No. 4100.

4100. K & E Stadia Slide Rule, engine divided, 10 in., divisions on white facings, "Frameless" Glass indicator; in Case . . . . . each $

4101. K & E Stadia Slide Rule, like No. 4100, but 20 in.; in Case . . . . . "

The very simple Directions are printed on the rule.

This form of Stadia Slide Rule is remarkable for its simplicity. By one setting of the slide (always to the left), the horizontal distance and vertical height can be obtained at once, in every case where the Stadia rod reading and elevation of the telescope are known. The two equations thus solved are those generally used for inclined stadia measurements, viz.: Horizontal Distance = Rod reading $\times$ $\cos.^2\alpha$. Vertical Height = Rod Reading $\times \frac{\sin 2\,\alpha}{2}$.

The under side of the slide has a scale corresponding to the lower scale of the rule and resembling the A and B scales of the Mannheim and Duplex rules, so that the rule can be used also for ordinary slide rule computations.

SURVEYOR'S DUPLEX SLIDE RULE.

K & E ADJUSTABLE.



Front.



Back.

No. 4102.

4102. Surveyor's Duplex Slide Rule, K & E Adjustable, 20 in., Duplex type, engine divided, divisions on white facings, "Frameless" Glass Indicator; in Case, with Directions . . . . . each $

The fact that all astronomical data essential to surveying, such as azimuth, time-latitude, etc., can be ascertained by means of the usual type of Transit with vertical circle but without solar attachment, while generally known, is rather seldom utilized in this country. The main reason for this surprising condition is the difficulty of computing, in the field, by spherical trigonometry, the results of observations.

The new K & E Surveyor's Slide Rule entirely eliminates this difficulty by reducing the hitherto complicated calculations to mere mechanical operations, thereby rendering the method of field astronomy with the regular Engineer's Transit extremely simple and practical.

One face is arranged for the determination of the meridian by direct solar observations; it also carries the sine and cosine scales used in computing the latitudes and departures of the course.

The other face has the usual scales A, B, CI, C and D, for all general numerical calculating, as well as two full length stadia scales for computing horizontal distances and vertical heights.

FOR LEATHER CASES FOR SLIDE RULES, see page 232.

FOR MAGNIFIERS, see page 247.

WEBB'S STADIA SLIDE RULE.



No. 4105.

4105. Webb's Stadia Slide Rule (cylindrical). . . . . each $

The Webb Stadia Slide Rule is so designed that its capacity is equal to that of a straight slide rule of a length of more than four feet, but it has been compacted in a cylindrical form about 15 inches long, diameter 1¼ inches.

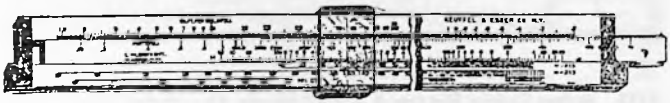
It is, therefore, of a convenient size to carry and use in the field, thus facilitating the drawing of field maps. The desired quantities are given with a degree of accuracy which is commensurate with the probable accuracy of the observations as read, the "logarithmic unit" being 12½ inches long.

The graduations on the wooden cylinder and the metal sleeve are on paper protected by a hard transparent coating. The directions, which are very simple, are printed on the rule.

NORDELL SEWER SLIDE RULE,

K & E ADJUSTABLE.

DUPLEX TYPE.

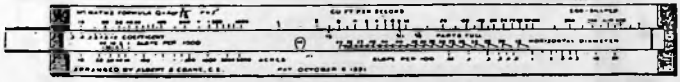


No. 4128.

4128. Nordell Sewer Slide Rule, K & E Adjustable, 20 in., Duplex type, engine divided, divisions on white facings, "Frameless" Glass Indicator; in Case, with Directions, ... each $

This slide rule is based on Kutter's formula for circular sewers. It greatly simplifies the method of determining the time of flow, and is adapted for the ready solution of problems involving sizes, capacities, drops, and velocities of sewers. The reverse face has the regular Mannheim 20 in. A, B, C and D scales for general computations.

CRANE'S SEWER SLIDE RULE.

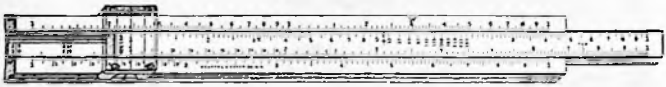


No. 4132.

4132. Crane's Sewer Slide Rule, 10 in., printed graduations, with Directions . . . . . each $

Crane's Sewer Slide Rule is based on McMath's formula for amount of storm water and Kutter's formula for capacities; for circular sewers from 6 to 180 in. diam. and eggshaped sewers from 18 to 60 in. horizontal diameter; ratio of radii 3 : 2.

THE ROYLANCE ELECTRICAL SLIDE RULE, K & E ADJUSTABLE.



No. 4133.

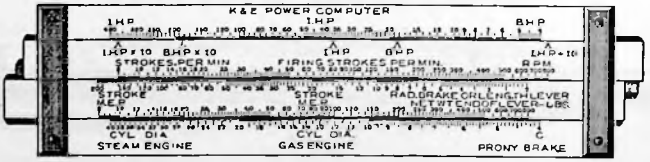
4133. **Roylance Electrical Slide Rule,** K & E Adjustable, 8 in., Mannheim Type, engine divided on white facings, "Frameless" Glass Indicator; in Leather Case, with Directions . . . each $

The Roylance Electrical Slide Rule is a modification of our regular Mannheim Slide Rule No. 4035 and can be used for all the calculations made with the ordinary Slide Rule. In addition to the usual Mannheim scales it carries a series of scales or gauge marks by means of which the different properties of copper wire, such as size, conductivity, weight, etc., may be determined without the use of tables. Scales showing the carrying capacity for different kinds and sizes of wire are placed in the groove in the body of the Rule beneath the Slide. The upper row of figures shows the ampere carrying capacity of rubber covered wire; the second row, weather proof wire; third row, rubber covered cable; fourth row, weather proof cable. For the third and fourth rows, the gauge marks read hundred thousand circular mils; No. 8 reads 800,000 cm., No. 14, 1,400,000 cm., etc. These scales are also read in connection with the gauge marks by means of the indicator.

Other features embodied in the rule are the extra hair lines on the Indicator for the calculation of circular areas, the special gauge mark (746) for the conversion of Horse-power and Kilowatts, and a special set of figures giving the temperature of wire in degrees Centigrade corresponding to resistance in ohms per 1000 feet. In other respects the Slide Rule is our regular Mannheim type, and the general directions for its use may be applied.

POWER COMPUTING SLIDE RULE, K & E ADJUSTABLE.

DUPLEX TYPE



No. 4135.

4135. K & E Power Computing Slide Rule, Patented, 7¼ in., Duplex Type, engine divided, divisions on white facings; in sewed Leather Case, with Directions . . . . . each $

This Slide Rule is specially designed for use in computing Power and Dimensions of Steam, Gas and Oil Engines; it gives all data for finding speed, length of stroke, dimensions of cylinder, etc.

The face of the rule shown carries five series of special graduations, to be used in determining B. H. P., I. H. P., or principal Dimensions of Steam, Gas and Oil Engines of any size. On the reverse face of the Rule are engraved the A, B, C and D scales usually found on the **Mannheim** Slide Rule.

ALLAN FRICTION HEAD SLIDE RULE, K & E ADJUSTABLE.



Front.



Back.

No. 4142.

4142. Allan Friction Head Slide Rule, K & E Adjustable, 20 in., Duplex Type, engine divided, divisions on white facings; new K & E "Frameless" Glass Indicator; in Case, with clear and comprehensive directions, ... each $

Separate copies of the Manual . . . . . "

This Slide Rule is offered to the engineering profession as a means whereby systems of steam and hot water heating and steam power piping may be designed to meet the growing demand for correct pipe sizing. It was made possible by an invention, protected by U. S. patent, for which we hold the exclusive manufacturing license; this invention covers an arrangement of logarithmic scales (applicable to our regular type of slide rule and having the same simplicity of operation), by means of which the relationship between five variable quantities can be determined.

As applied to the subject matter, these variables are the volume of flow, loss of pressure due to friction, diameter of pipe, velocity of flow, and the gauge pressure in steam work or temperature drop in water work. The following tabulation gives the range of information covered:

STEAM:	VOLUME	4500 to 65,000,000 B. T. U. per hr. (Heating)
		4.5 " 65,000 lbs. wgt. " (Power)
	FRICTION	.01 to 100 lbs. per sq. in. per 100 ft. pipe
	DIAMETER	½ in. to 26 in. O. D. (Commercial sizes)
	VELOCITY	7 to 250 ft. per sec.
	GAUGE PRESS.	1 to 10 lbs. (Heating)
		50 " 250 " (Power)
WATER:	VOLUME	6500 to 100,000,000 B. T. U. per hr. (Heating)
		0.65 to 10,000 gal. per. min. (Water supply)
	FRICTION	.01 to 100 ft. head per 100 ft. pipe
	DIAMETER	½ in. to 26 in. O. D. (Commercial sizes)
	VELOCITY	0.7 to 25 ft. per sec.
	TEMP. DROP	10 to 40 deg. F.

Unusual care has been taken to make the Manual of Instructions clear and comprehensive.

The arrangement of logarithmic scales is based on equations which, after a thorough and painstaking research of all available data, seemed to offer the best assurance of permanency and consistent results, and these equations are given in full in the Manual.

Practical examples and piping diagrams covering all applications of the principles involved are fully worked out and explained for both steam and water.

The resistance of valves, fittings, etc., is tabulated in accordance with the best available information.

The Manual fully covers the use of the rule in ordinary gravity work, as well as its application to large installations of hot water heating under forced circulation,—installations which have recently become very popular for manufacturing plants and institutions.
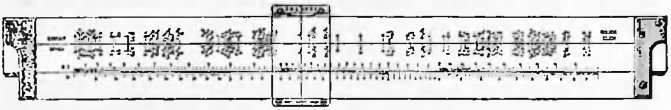
The rule is made in the 20 in. Duplex type only, and is provided with our new "Frameless" Glass Indicator, the steam scales being on one face and the water scales on the other.

Commercial sizes of steel and wrought iron pipe are indicated in red figures; theoretical diameters and all other figures and lettering are in black.

CHEMIST'S DUPLEX SLIDE RULE, K & E ADJUSTABLE.



Front.



Back.
No 4160.

4160. Chemist's Duplex Slide Rule, K & E Adjustable, 10 in., engine divided, divisions on white facings, "Frameless" glass Indicator; in Case, with Directions . . . . . ,

The Chemist's Duplex Slide Rule, designed by Dr. R. Harman Ashley, makes possible the rapid solution of problems in Stoichiometry, such as Gravimetric Analysis, Volumetric Analysis, Equivalents, Percentage Composition, Conversion Factors, Volume of Gas from a given weight of substance at different temperatures and pressures, and many other analogous problems.

Aside from the solution of the chemical problems above referred to, any arithmetical problems solvable by logarithms are readily and accurately done with a minimum number of settings.

UREA INDEX SLIDE RULE

A Slide Rule Modified for Calculation of Urea Index and Sodium Chloride Formulæ, as described in the Journal of Experimental Medicine, 1915, vol. XXII, pp. 212-236, by Franklin C. Mc Lean, Ph. D., M. D., Rockefeller Institute for Medical Research.

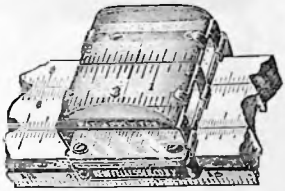


No. 4165.

4165. Slide Rule (Mannheim Type) modified for calculations of Urea Index and Sodium Chloride Formulæ; K & E Adjustable, 10 in., engine divided, divisions on white facings, "Frameless" Glass Indicator; in sewed Leather Case, with Directions . . . . . each $

MAGNIFIERS FOR SLIDE RULES.

INDICATOR WITH DECIMAL POINTER.



No. 4085 B.



No. 4086.

4085 A. Magnifiers for Mannheim Slide Rules, 5 in., 8 in. . . . . each $

4085 B. Magnifiers for the following Slide Rules: Mannheim, 10 in., 16 in., 20 in.; Polyphase, Favorite, Polyphase Duplex 8 in., 10 in.; Stadia 10 in., 20 in. . . . . "

4085 C. Magnifiers for Polyphase Duplex 20 in., and Log Log Slide Rules . . . . . "

When ordering please indicate kind of slide rule for which the magnifier is wanted.

The Magnifiers are mounted in a metal frame and are applied to the rule by springing them on the glass indicator. The lens is thus always in position for reading and is always in focus. The magnification is ample for even the finest graduations, the field covers the full area of the indicator, and the lines do not appear distorted. These Magnifiers cannot be used on glass indicators with two hairlines.

4086. Glass Indicator, with Decimal Pointer . . . . . each $
do. do. in place of plain Glass Indicator, add . . . . "

No. 4086 is furnished for the Mannheim style of Slide Rules only. The Magnifiers No. 4085 do not fit these Indicators.

BOOKS ON THE SLIDE RULE.

PUBLISHED BY KEUFFEL & ESSER CO.

BK 25. The Use of the Slide Rule, a Practical Manual of Slide Rule Instruction; by Prof. Allan R. Cullimore, formerly Dean of Toledo University; 8 vo. 36 pages. Bound in Cloth . . . each $

4087 B. The Mannheim and Polyphase Slide Rules (Mannheim Type); complete manual; by Wm. Cox. Bound in Paper . . . each $

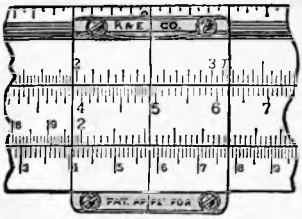
4087 E. The Mannheim (Polyphase) and the Duplex (Polyphase Duplex) Slide Rules; complete manual, bound together. . . . . each $

4087 D. Manual 4087 E, but in stiff linen cover. . . . . each $

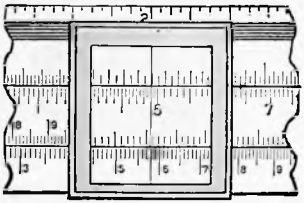
4087 F. The Mannheim and Polyphase Slide Rules; a self teaching manual with numerous illustrations and examples for practice; suitable for use in classes studying Algebra, Trigonometry, and practical mathematics, containing adequate formulae and technical matter for engineers; by Wm. E. Breckenridge, A. M., Columbia University, 8 vo., 80 pages, ... each $

THE NEW "FRAMELESS" INDICATOR

FOR K & E SLIDE RULES.



No. 1. New Type Indicator
(*Never hides any figures*)



No. 2. Old Type Indicator
(*Showing how it hides important figures*)

K & E *adjustable* Slide Rules of the Mannheim and Duplex type are now equipped with our patent "Frameless" Indicator. Every figure on the rule is clearly visible at all times, there being no side pieces to the holder of the glass indicator, and, therefore, nothing to hide any of the figures on the rule. Many times, after setting the old type Indicator or Runner, the user would find that he could not read the result because important figures were hidden by the indicator frame. The new K & E "Frameless" Indicator entirely obviates this difficulty, and vastly increases the ease and rapidity of using the Slide Rule.

"FRAMELESS" GLASS INDICATORS FOR THE FOLLOWING K & E SLIDE RULES:

Complete Indicators for	each
Mannheim, Nos. 4031 to 4041 F	$
" " 4045 and 4051	
Polyphase, Nos. 4053-2 to -5	
Polyphase Duplex, No. 4088-2, -3	
" " " 4088-5	
Log Log Duplex, No. 4092	
Merchants, No. 4095	

Complete Indicators for	each
Stadia, No. 4100	$
" " 4101	
Surveyor's Duplex, No. 4102	
Nordell, No. 4128	
Roylance Electrical, No. 4133	
Allan Friction Head, No. 4142	
Chemist's Duplex, No. 4160	
Urea Index, No. 4165	

The above have one hairline, except the indicator for No. 4133, (Roylance Electrical Slide Rule) which has three hairlines.

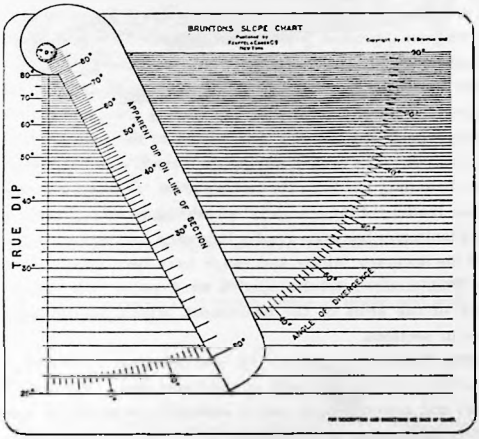
"Frameless" Glass Indicator, but with two hairlines (instead of one) extra $

Do. but with two hairlines spaced to a stated ratio "

For glasses only (one hairline), the prices are:

For Mannheim, Nos. 4031 to 4041-F Stadia No. 4100 Urea Index, No. 4165	Glass only	each $
	" fitted	"
Mannheim, Nos. 4045 and 4051 Stadia, No. 4101 Polyphase, Nos. 4053-2 to -5	" only	"
	" fitted	"
Roylance, No. 4133 (*Three Hairlines*)	Glass only	"
	" fitted	"
Polyphase Duplex, Nos. 4088-2 and -3 Merchants, No. 4095	" only	"
	" fitted	"
Polyphase Duplex, No. 4088-5 Log Log, No. 4092 Surveyor's Duplex, No. 4102 Nordell, No. 4128 Allan Friction Head, No. 4142 Chemist's Duplex, No. 4160	Glass only	"
	" fitted	"

BRUNTON SLOPE CHART.



4185. Brunton Slope Chart, heavy cardboard sheet 11¾×11 in., with horizontal scale from 20° to 90° ("True Dip" scale); quadrant scale, divided to degrees ("Angle of Divergence"); a swinging arm with scale from 20° to 90° on its radial edge ("Apparent Dip on Line of Section"); full Directions printed on back of Chart . . . . . each $

The Brunton Slope Chart enables the user instantly to obtain the apparent dip from the true dip, or vice versa; mechanically solving the equation: Tan C° = Cosine A° Tan B°, in which C is the apparent dip, A, the angle of divergence, and B, the true dip.

In addition to its use in the preparation of maps and geological sections, the chart is also extremely useful for giving the valley angles in hoppers, ore bins, etc.

PLANIMETERS AND INTEGRATORS.

Of all mechanical devices for computation, **Planimeters** and **Integrators** rank foremost as the most ingenious and useful aids to the modern Civil, Mechanical, Mining, or Marine Engineer.

Planimeters are designed for ascertaining by a simple mechanical operation, the area of any plane surface represented by a figure drawn to any scale, such as indicator diagrams, profiles, plans, sections, etc. They are classified as **Polar Planimeters** and **Rolling Planimeters.**

The **Polar Planimeter,** invented by Prof. Amsler in 1856, consists of two principal parts, the **tracer arm** carrying the tracing point and the carriage with the measuring wheel, and the **pole arm** affixed to the pole around which the instrument revolves. The area of any figure is readily and accurately obtained by tracing its boundary line with the tracing point, whereupon the result is computed from the reading of the graduated measuring wheel. This original design of the Polar Planimeter has been greatly improved and perfected in the course of time, and its accuracy, utility and range have been greatly increased. As all the Polar Planimeters revolve around a fixed point, their scope is limited by the length of the arms of the instrument, which necessitates measuring large figures in sections.

The **Rolling Planimeter** measures by one operation figures of any length, and up to a width equal to the length of the tracer arm. It moves in a straight line, on broad and heavy rollers, and is especially adapted for measuring the area of profiles, deck-plans of ships, etc.

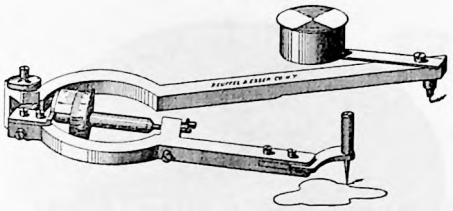
INTEGRATORS AND THE INTEGRAPH

ascertain the area and moments relative to any axis of any figure, by simply tracing its outline. They are an invaluable aid to Civil and Mechanical Engineers, Bridge Builders, Naval Architects, etc. They greatly facilitate the finding of the displacement, moments of stability and inertia, center of gravity, etc., of ships, the tensile strength, resistance, safe load, etc., of cables, tracks, beams and girders, contents of embankments, cuttings, etc. On the Integrators the readings are taken from recording discs. The Integraph draws automatically the integral curves, giving a graphic representation of the integration, a feature very valuable to ship builders and others as it saves the computing of these curves.

Planimeters and Integrators are so simple, that they can be used by anybody after a little practice. They soon pay for themselves through their saving of time and labor, and give more accurate results than any other method of computation.

POLAR PLANIMETERS.

Illustration ½ size.

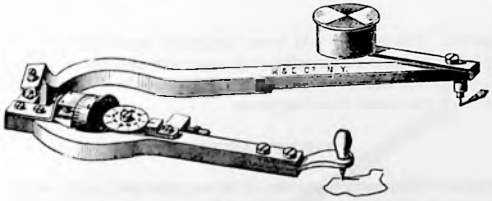


No. 4210.

4210. Polar Planimeter, fixed tracer arm, improved needle pole*; with table of settings, in Case, with Manual . . . each $

No. 4210 represents the Polar Planimeter in its simplest form. It measures up to 10 square inches in tenths and hundredths of a square inch.

Illustration ½ size.



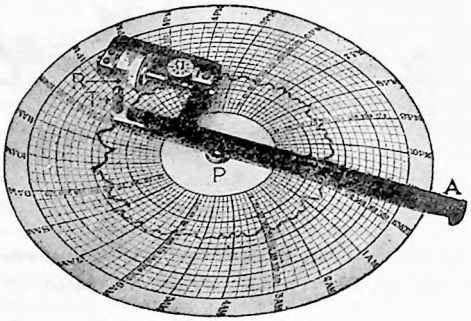
No. 4212.

4212. Polar Planimeter, fixed tracer arm, improved needle pole*, with horizontal recording wheel engaging with the measuring wheel and registering its revolutions; with table of settings, in Case, with Manual . . . . each $

The horizontal recording wheel registers 10 revolutions of the measuring wheel, so that areas of figures up to 100 square inches can be measured.

* The improvement of the needle pole consists in a counter weight attached to a bar which revolves around the pole, and counterbalances the weight of the instrument proper in any position.

RADIAL PLANIMETER.



4215. Radial Planimeter, in Case, with directions, ... each $

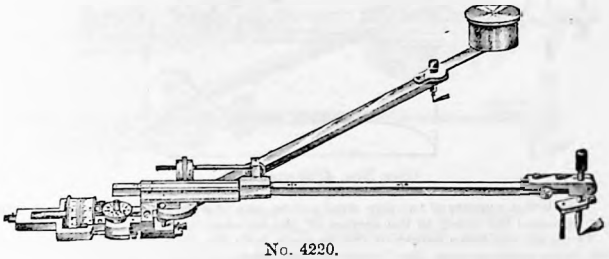
The Radial Planimeter has been designed especially for the purpose of measuring mean heights of circular diagrams with uniformly spaced ordinates. It covers a circle one and one-half to thirteen inches in diameter, thus embracing the range of the usual disc diagrams.

DESCRIPTION.

The Radial Planimeter consists of three principal parts, as shown in cut, namely: Center pin P, tracer arm AT and measuring wheel R. In the under surface of arm AT is a groove into which fits the head of the center pin P. Measuring wheel R revolves on an axis parallel to the tracer arm, so that if the tracer point T is moved in a radial direction, the measuring wheel will not record; but if the tracer point is moved in any other direction, the measuring wheel revolves and records. The amount of the revolution depends on the distance of the tracer point from the center and the extent of the circular movement around point P.

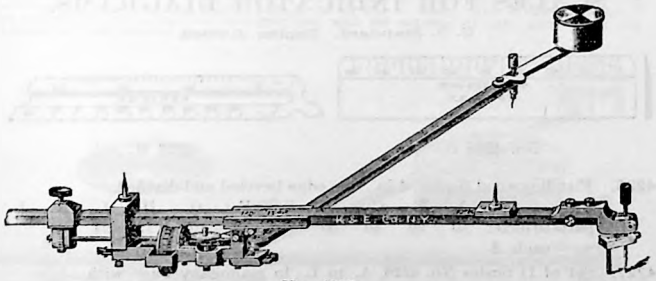
The amount of revolution of the measuring wheel R is indicated by means of a graduated drum firmly attached to the measuring wheel R, and a vernier. The drum is graduated into 100 parts of a revolution, while $\frac{1}{1000}$ part can be read by means of the vernier. Complete revolutions up to 10 are indicated on a small, horizontal disc, which is actuated by a worm cut into the axis of the measuring wheel.

POLAR PLANIMETERS.



No. 4220.

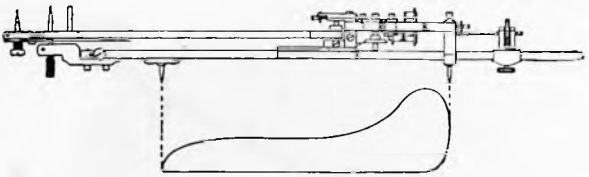
4220. Polar Planimeter (Amsler's pattern), nickel silver; adjustable tracer arm about 9 in. with index marks giving settings for various ratios, and with clamp and slow-motion screw; in Case, with Manual. . . . . each $



No. 4225.

4225. Polar Planimeter (Amsler's pattern), nickel silver, similar to 4220, but with steel points with nickel silver caps (see cut 4235, page 255) on top of bars, for rapidly finding the **Mean Height of Indicator Diagrams** (see next page); in Case, with Manual. . . . . each $

DEVICE FOR FINDING THE MEAN HEIGHT OF INDICATOR DIAGRAMS.



(See Nos. 4225 and 4235.)

This device consists of two fine steel points, one attached to the upper side of the tracer arm, and the other to the surface of the carriage in which this arm slides.

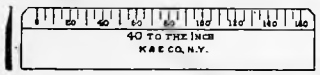
To obtain the mean height of the diagram, hold the planimeter up-side down and adjust these points so that the distance between them coincides exactly with the length of the diagram, then clamp the arm and proceed in the usual way exactly as if the area of the diagram were sought. Instead of giving, however, the area, the setting of the tracer arm is by this means such, that the difference between the readings at the beginning and end of the operation, divided by 0.4, shows the mean height of the diagram in inches.

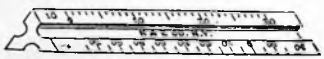
Example: Second reading.....4.786
First reading.....4.322

Then 4.786 — 4.322 ÷ 0.4 = 1.16 inches = the mean height.

SCALES FOR INDICATOR DIAGRAMS.

U. S. Standard. Engine divided.





No. 4226 C. 4228 M.

4226. Flat Boxwood Scales. 4 in., one edge beveled and divided,

	A.	B.	C.	D.	E.	F.	G.	H.	J.	K.	L.
parts to inch:	10	20	40	50	60	80	100	12	24	32	

each $

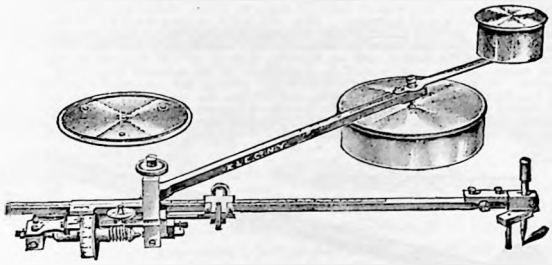
4227. Set of 11 Scales No. 4226, A. to L.; in mahogany Case with numbered slots . . . . . set $

4228. Triangular Boxwood Scale, 3 in., six edges divided,

M. Indicator Scales, graduated 10, 20, 30, 40, 50, 60 parts to in., each $
N. " " " 20, 40, 50, 60, 80, 100 " " " "
O. " " " 10, 15, 25, 30, 40, 70 " " " "
P. " " " 10, 20, 25, 60, 80, 100 " " " "
R. " " " 12, 24, 32, 64, 40, 60 " " " "

Indicator Scales with other graduations made to order.

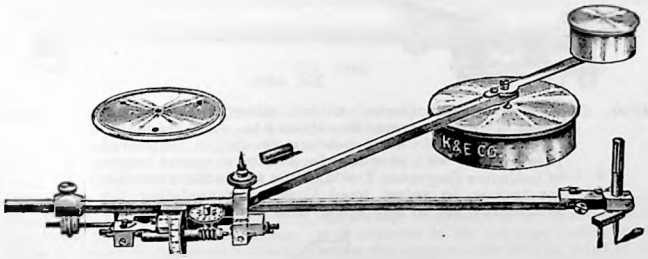
POLAR PLANIMETERS.



No. 4230.

4230. Improved Polar Planimeter, nickel silver, adjustable tracer arm about 8½ in., fully graduated, with vernier and clamp with slow-motion screw; ball pole, pole weight and balancing weight; with Testing Disc and table of settings for English and Metric measures; in polished mahogany Case, accommodating the instrument when set to any scale, with Manual . . . . . each $

As the tracer arm is fully graduated, very fine settings can be effected with great accuracy for any scale in U. S. Standard or any foreign measurement, and allowance can be made for the shrinkage of drawings. The tracer arm is provided with index marks for a number of scales for Inches and Metric measures. The Testing Disc greatly facilitates the rapid finding of these settings, serves to prove the accuracy of the instrument and is an aid in adjusting it. By shifting the pole weight, which is smooth underneath, the measuring wheel can be easily set to zero. The different parts of the instrument are adjustable and provided with set screws, so that corrections can be made for instrumental errors.



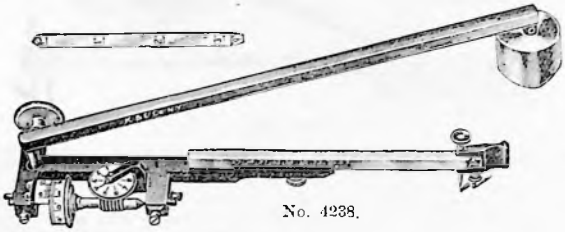
No. 4235.

4235. Improved Polar Planimeter, nickel silver, like 4230, but with steel points (with nickel silver screw caps) for finding the **Mean Height of Indicator Diagrams** (as explained on page 254) . . . . . each $

The Steel Points of this instrument when not in use are protected by nickel silver caps.

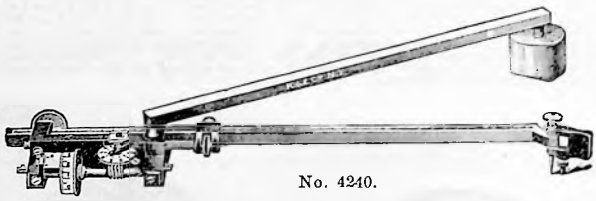
COMPENSATING PLANIMETERS.

In the Compensating Planimeters Nos. 4238, 4240 and 4242, the pole arm is held in the wheel carriage of the tracer arm by a pivot which ends in a steel ball, forming a ball joint with the wheel carriage. The ball joint cannot become loose or shaky, nor is it liable to be injured in adjustment of the tracer arm or during shipment, as each part can be handled and is stored in the case separately (see cut No. 4242). This construction gives the tracer arm an angular motion of 180 degrees in either direction, and the range of the instrument is, therefore, much greater than that of the usual planimeter. By measuring a diagram with the pole on the left, and then again with the pole on the right side of the tracer arm, and taking the mean of the readings, all instrumental errors are compensated. The pole is of improved pattern, combining the advantages of the pole weight and needle pole. The tracing point has also been improved; its construction can be clearly seen in the cuts.



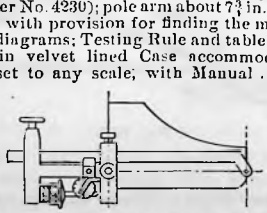
No. 4238.

4238. Compensating Planimeter, nickel silver and bronzed brass, adjustable tracer arm about 6¾ in. provided with a short graduation (from 280 to 360); pole arm about 7¾ in., improved pole weight; Testing Rule and table of settings for inches; in velvet-lined Case, with Manual . . each $



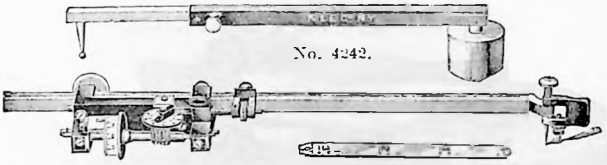
No. 4240.

4240. Compensating Planimeter, nickel silver and bronzed brass; adjustable tracer arm about 9 in., fully graduated (see note under No. 4230); pole arm about 7¾ in., improved pole weight; with provision for finding the mean height of indicator diagrams; Testing Rule and table of settings for inches; in velvet lined Case accommodating the instrument, set to any scale, with Manual . . . . . each $



These Planimeters are also equipped for finding the mean height of indicator diagrams, as the tracer arm can be easily adjusted to the length of the base, by placing the tracer point at the right-hand end of the base, and sliding it in its sleeve until the other end of the base becomes visible in the center of the small opening in the pole bearing, the pole arm being removed.

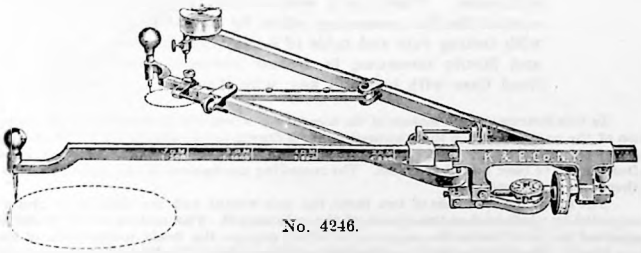
COMPENSATING PLANIMETERS.



No. 4242.

4242. Compensating Planimeter, like 4240, but with adjustable pole arm extending to about 13 in.; with Manual . . . . each $

The adjustable Pole Arm bears index marks for the different settings furnished with the instrument, and can be adjusted so that when the instrument is used with the pole inside of a figure, the constant is a round number, 20,000, for any setting. The instrument is used in the same way with the pole inside as with the pole outside, and by tracing the figure with the pole on the right and on the left of the tracer arm (about 13 inches) and taking the mean of the readings, large areas can be measured with great accuracy. The extensibility of the pole arm, and the great range of the tracer arm, permit of measuring very large figures with the pole outside. By reducing the length of the pole and tracer arms, the instrument can be used on a very small surface.



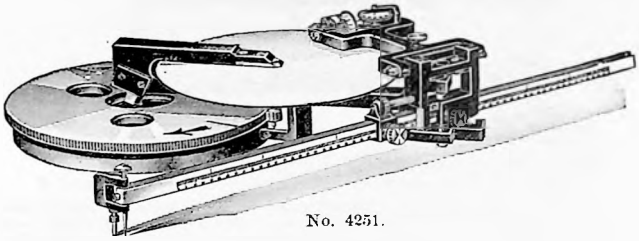
No. 4246.

4246. Pantograph Polar Planimeter, nickel silver, two adjustable tracer arms graduated to millimeters and with index marks for different ratios, clamp and slow motion screw to each tracer arm, with needle pole; in velvet lined Case, with Manual . . . . . each $

This Planimeter is especially adapted for measuring very large and very small figures. The long tracer arm (about 11 in.) has a range covering a 38 in. diameter circle and is used for measuring large figures. It is adjusted to the required scale, and the figure is traced in the usual manner. During the operation the tracing point of the shorter tracer arm had better be removed.

The smaller tracer arm (about 7½ in.) is used for measuring very small figures. It is set to the proper index mark and the figure is traced by so guiding with the tracing point of the longer arm that the point of the smaller arm follows the outline. This is not at all difficult as the two tracing points travel alike. The setting of the longer tracer arm is indifferent in this case. The starting point is best taken at the tracer of the longer arm. The construction of the instrument is such, that, when the smaller tracer arm is used, a greater travel of the measuring wheel for a given area is effected; consequently the value of the wheel unit is smaller, and the result more accurate.

PRECISION DISC PLANIMETER.



No. 4251.

4251. Precision Polar Disc Planimeter, nickel silver and brass, with aluminum paper-faced contact disc for the measuring wheel, latest construction, adjustable tracer arm 13¾ in. fully graduated to ½ millimeters, with micrometer screw to vernier reading to $\frac{1}{10}$ millimeter. Heavy pole weight 5¾ in. diameter, contact disc for measuring wheel 5¼ in. diameter, with testing rule and table of settings for English and Metric measures; in leather covered velvet lined Case with lock and key, with Manual . . . each $

In this instrument the motion of the measuring wheel is independent of the condition of the paper on which the measured figure is drawn, as the measuring wheel revolves by contact with the plane disc. Reliable computations can be made, therefore, on plans after they have been folded or rolled. The recording mechanism is the same as on our other large planimeters.

The instrument consists of two parts, the pole weight and the planimeter proper, connected by a ball joint at the center of the pole weight. The motion of the tracer is imparted to a pivot (under the contact disc) which engages the finely toothed rim of the pole weight, transmitting rotary motion to the contact disc. The hinged carriage can be folded back to facilitate cleaning the disc. Improved tracer point with spring, (with a support to keep it clear of the drawing, with winged handle.)



No. 4248.

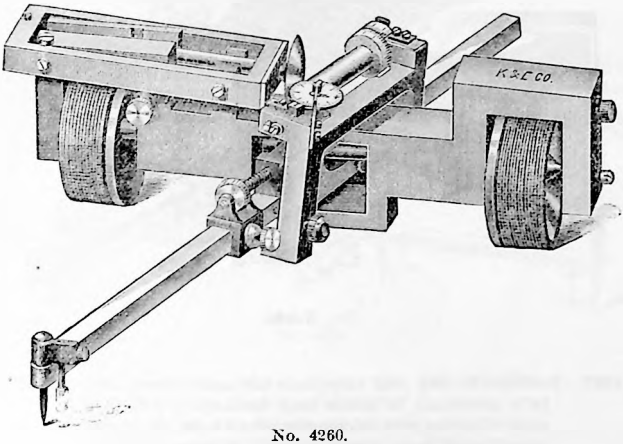


4249.

4248. Testing Disc, brass, engraved circle encloses an area of exactly 4 square inches; with three pins to prevent slipping. . . . . each $

4249. Testing Rule, nickel silver, for radii of 1, 2 and 3 inches, with center pin . . . . . each $

ROLLING PLANIMETERS.

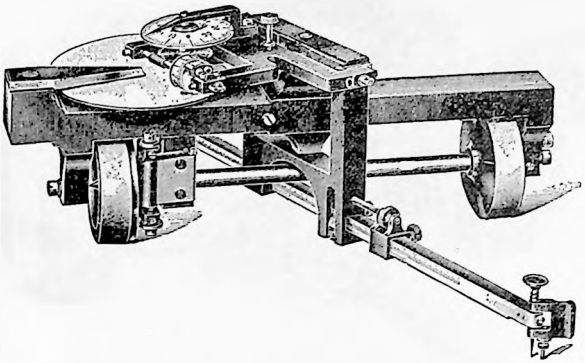


No. 4260.

4260. Precision Rolling Planimeter, nickel silver and brass, adjustable tracer arm fully graduated, 10 inches long, with 8-inch telescoping extension piece, Testing Rule and Table of Settings for English measure; in morocco Case, fitting instrument when set to any ratio, with lock and key; Manual . . . . . each $

The Rolling Planimeter moves on two broad rollers, from one of which motion is imparted to the recording mechanism. The measuring wheel revolves by contact with a polished sphere segment. Only the rollers and the tracer are in contact with the drawing, and the results are, therefore, not affected by irregularity of the paper. The area of a figure of any length, the width of which does not exceed the length of the extended tracer arm, can be measured in one operation.

PRECISION ROLLING DISC PLANIMETER.



No. N 4262.

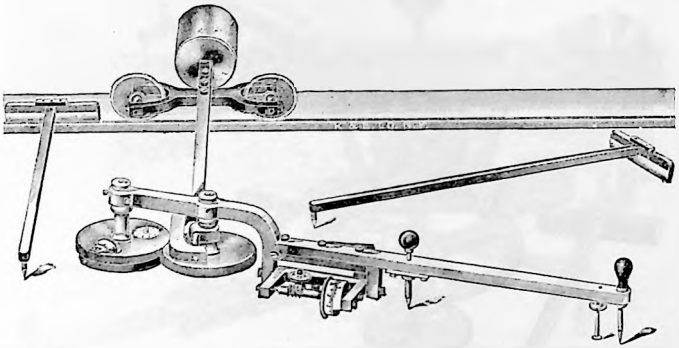
N 4262. Precision Rolling Disc Planimeter, adjustable tracer arm fully graduated, 12 inches long, telescoping extension piece 10 inches, with micrometer adjustment, adjustable for values of the vernier unit from 0.0032 square inch to 0.0005 square inch. Testing Rule and Table of settings for English measure; in morocco Case, with lock and key; Manual . . . . . each $

The rolling disc planimeter is a combination of the rolling sphere planimeter and the disc polar planimeter; the integration parts (sphere and cylinder) are replaced by somewhat less intricate parts (disc and roller). The maximum area that can be measured in one operation with the rolling disc planimeter is a rectangle of any desired length, width not exceeding the length of the adjusted tracer arm.

The above illustration represents the instrument about ⅓ actual size. The distance between the two rollers is 17 cm (6¾"), so that diagrams of indicators (Wattmeters, steam-gauges etc.) up to a width of 17 cm (6¾") and any desired length can be measured without the rollers touching the paper. The aluminum disc, which is covered with paper, is fixed on a vertical axis, which can be easily turned between two pivots; the small toothed wheel on the axis, engages automatically, i. e. elastically, in the gearing of the measuring roller, so that no obstruction or deviation from the rectilinear travelling of the running roller is caused owing to dust or other extraneous matter which may get in between the gearing. The measuring roller and its frame are similar to those of the disc polar planimeter; the gear wheel indicates up to 100 revolutions of the measuring roller. The tracer arm, its graduation, length and arrangement, and the values of the vernier units of the measuring roller are the same as in the rolling sphere planimeter. The handling is exactly the same as for that instrument.

AMSLER'S MECHANICAL INTEGRATORS.

Illustration about ⅓ size.



No. 4270.

4270. Amsler's Integrator, nickel silver, with **two Recording Mechanisms** giving the **Area** and **Moment** of any figure; two Tracing Points, two Gauges for adjusting instrument to axis of moments; grooved Steel Rail 29 inches; in hardwood Case, with Directions . . . . . each $

*4272. Amsler's Integrator, like No. 4270, but **Brass** . . . . . "

Grooved Steel Rails of other lengths furnished to order.

Integrators Nos. 4270 and 4272 give the area and moment of any figure by a simple mechanical operation. They are provided with two tracing points, for large and small figures. The one nearest to the center of rotation of the instrument effects a greater travel of the measuring wheel, consequently the area value of the wheel unit is smaller and the result more accurate. Large figures can be measured in sections. Area and moment of figures drawn to scale can be easily obtained by means of a formula furnished with each instrument.

The range of the instrument is:

Longitudinal	26 inches
Transverse	15 "

*** These Integrators are not carried in stock, and are imported to order only.**

AMSLER'S MECHANICAL INTEGRATORS.

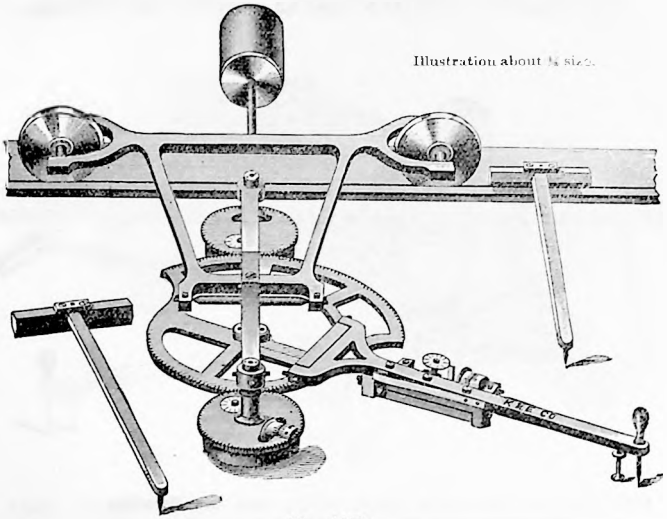


Illustration about ¼ size.

No. 4280.

4280. Amsler's Integrator, nickel silver, with **three Measuring Wheels with Recording Discs** giving the **Area, Moment,** and **Moment of Inertia** of any figure: two Tracing Points, two Gauges for adjusting instrument to axis of moments; instrument in hardwood Case. Grooved Steel Rail 59 in., in separate hardwood Case. With Directions . . . . each $

*4282. Amsler's Integrator, like No. 4280, but **Brass** . . . . . "

Integrators Nos. 4280 and 4282 are provided with a third train of recording wheels, which renders the moment of inertia of the figure measured.

Their range is: Longitudinal . . . . . 50 inches
Transverse . . . . . 13 "

4286. Amsler's Integrator, like No. 4280, but **Extra Large,** nickel silver, three Tracing Points, grooved Steel Rail 78 in., each $

*4288. Amsler's Integrator, like No. 4286, but **Brass** . . . . . "

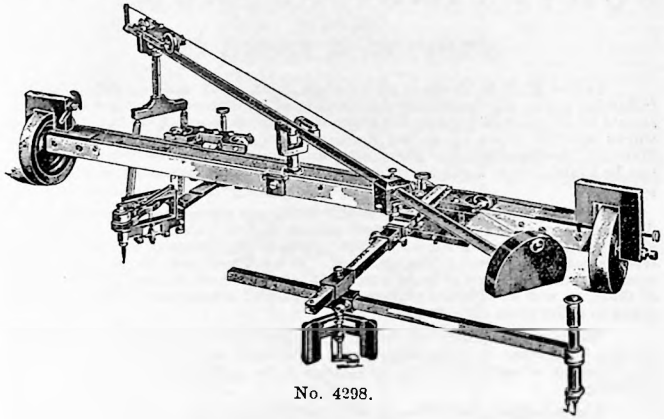
Integrators Nos. 4286 and 4288 are practically the same instruments as Nos. 4280 and 4282, but built on a larger scale, so that they measure proportionately larger figures by one operation.

Their range is: Longitudinal . . . . . 67 inches
Transverse . . . . . 26 "

Grooved Steel Rails of other lengths furnished to order.

* **These Integrators are not carried in stock, and are imported to order only.**

CORADI'S MECHANICAL INTEGRAPH.



No. 4298.

4296. Coradi's Mechanical Integraph, as described under No. 4298 but lateral travel of 10.3 in., and without the device for moving the tracer point laterally. The base can be set from 1.5 to 5.2 inches. . . . . each $

4298. Coradi's Mechanical Integraph, latest improved construction, nickel silver and brass. The instrument moves on two broad rollers. The carriages of the tracing and integrating points have a lateral travel of 21 in. The tracer arm (base rule) is graduated to $\frac{1}{10}$ inches with vernier reading to $\frac{1}{100}$ inches and micrometer screw. The base can be set from 2.5 to 8 inches. Device for moving the tracer point laterally so as to adjust it easily on the X-axis of the figure. The arm can be taken out and the tracer point, if required, fixed also on the left side of the base. Instrument complete, with testing rule, in walnut Case, with lock and key, with Directions . . . . . each $

Like the Mechanical Integrators, the Integraph, in a very short time comparatively, has proved to be an aid of no small consideration to Civil and Mechanical Engineers and especially Naval Architects. While it is necessary with the Integrator to compute the several curves, point by point, and to construct them by means of the computed points, the Integraph directly draws the curves on the paper, thus giving a graphical representation of the integration. The operator traces the outline of the figure, i. e., the differential curve, and the pen or pencil point automatically draws the integral curve. The value of the ordinate of this integral curve can be measured off on the paper or read on a finely graduated bar. This value, multiplied by the constant furnished with the instrument, gives the area of the figure. By regarding the new curve as the differential curve, and tracing it in the same manner in which the first one was traced, the integral curve of the next higher order is drawn, the ordinate of which, multiplied by the constant, gives the moment of the original diagram. By repeating this operation, the moment of inertia, moments of the 4th, 5th, etc., order can be readily found. By this means practically all problems of stability, etc., may be solved almost entirely by mechanical operations, and much labor and brain work saved.

IMPROVED

SURVEYING INSTRUMENTS

MADE BY

KEUFFEL & ESSER CO.

In the K & E Transits and Levels, illustrated and described in the following pages, are incorporated a number of important improvements which should be of great interest to the engineering profession. Our list, therefore, shows specific types of surveying instruments excelling in Construction, Material, Workmanship and Precision. Many of the special features enumerated can be found in our instruments only, as they are protected by a number of patents.

The instruments presented in this catalogue represent our regular stock designs, but we are prepared to carry out, so far as possible, any suggestions as to details of construction which the practical experience of our professional friends may lead them to recommend. For convenience in ordering these special instruments, we give on pages 325, etc., a detailed description of some of them, as well as of some of the accessories and attachments which we have made to order from time to time.

We take this opportunity to thank our friends in the engineering profession for their criticisms and suggestions, which have assisted us so materially in the development of our Surveying Instruments to their present high state of perfection.

The description which we give in the following pages refers particularly to our extra-fine Engineer's Transits and Levels, Nos. 5040 to 5081 and Nos. 5063 to 5027, but the construction of the more important parts, such as centers, graduations, etc., is practically the same in all of our instruments.*

TRANSITS.

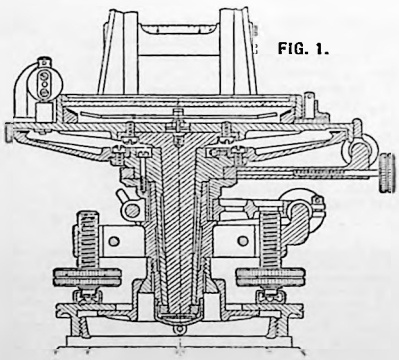


FIG. 1.

The parts of a transit upon which the accuracy of the instrument depends to the greatest extent, are the centers, with the leveling part, the plates carrying the graduations, the telescope and the spirit levels.

Centers. The centers of our transits are extra long to give stability and accuracy. They are made of metals of different hardness to reduce friction and to allow their moving upon each other with the least possible wear. The half ball joint, instead of being cast integrally with the leveling arms, forms part of a sleeve or collar which is attached to the leveling arm piece only throughout its upper half. This leaves a small annular space between this sleeve and the delicately fitted centers, effectually protecting them.

*For "Adjustments of K & E Surveying Instruments" see our annual publication "Solar Ephemeris and other Tables and Data useful to the Surveyor".

Leveling Arms (Fig. 1, Fig. 2 and Fig. 3). The Leveling piece is substantially constructed and allows ample shifting space. The arms are slotted and equipped with tension screws (Fig. 2, 5.) both to take up the wear and to provide against binding due to sudden change of temperature. The nickel silver Leveling Screws as well as the Clamp and Tangent Screws are cut on a precision lathe, insuring a thread, which, on account of its smoothness and uniformity, gives a perfect motion and long service. The center of the half ball joint is in the plane of the feet of the leveling screws; this prevents the binding of these screws when the instrument is leveled. All clamp and tangent screws are conveniently located, well protected, and out of the way. The heads of the clamp and tangent screws are differentiated so that "a touch tells".

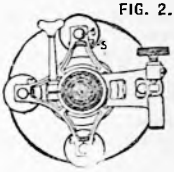


FIG. 2.

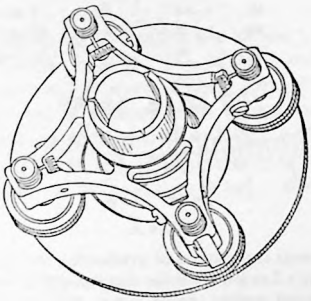
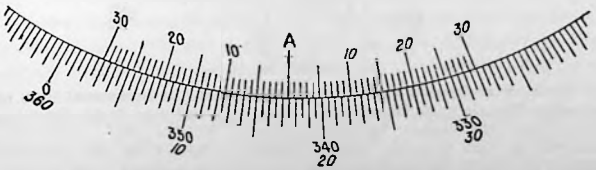


FIG. 3.

Horizontal Limb. A strip of rolled *silver* is inlaid in the upper surface of the horizontal limb, and into this the graduations are cut by an automatic dividing engine of our own design and construction. *The uniformity and accuracy of their graduations have won for our instruments a recognized position among users of precision instruments*, including many branches of the Federal and Municipal Governments, as well as scientific institutions of the highest standing.

The Limbs of Transits are graduated in various ways. The ordinary transit is usually graduated to read to single minutes, but we make and list instruments to read to 30, 20, 10 and 5 seconds, or to decimals of a degree (10ths, 50ths, 100ths or 200ths, see style G, page 268). We are also prepared to furnish to order, circles graduated centesimally (100 parts, grades, to the quadrant). The style of graduation and method of numbering the horizontal limb is shown below.



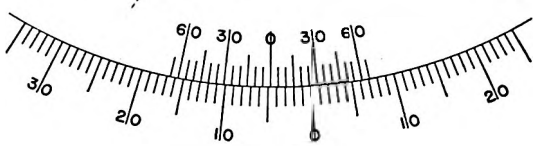
The two rows of numbers of the horizontal limb incline in opposite directions, corresponding to the direction in which the vernier reads for each row of figures.

KEUFFEL & ESSER CO. NEW YORK

GRADUATIONS.

Correct and distinct graduation of the limbs and verniers is of great importance in all surveying instruments. The following illustrations represent the different styles adopted by us for our Transits and Architect's Levels; they will be found convenient in arrangement and easy to read. In detail they are as follows:

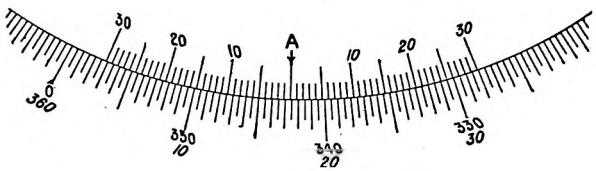
Style.	Reading of Limb.	Divisions of Limb.	=	Divisions of Vernier.	Reading of Vernier.	Kind of Vernier.
A.	Degrees	11	=	12	5 minutes	Double-direct
B.	30 minutes	29	=	30	1 "	" "
C.	20 "	39	=	40	30 seconds	" "
D.	20 "	59	=	60	20 "	Folded.
E.	30 "	29	=	30	1 minute	Double-direct
F.	15 "	44	=	45	20 seconds	" "
G.	15 "	49	=	50	$\frac{1}{300}$ degree	" "



Style A.

Style A represents the method of graduating the horizontal circle of our Architect's or Builder's Levels, with the corresponding vernier. This vernier, which is a **double-direct vernier**, reads, from the center to either extreme division (60), that part being used in which the direction of the numbering corresponds to the direction in which the limb is numbered and read. The limb is graduated to degrees, and the vernier (from 0 to 60) comprises 12 divisions; therefore, the reading of the vernier is 60 minutes ÷ 12 = 5 minutes.

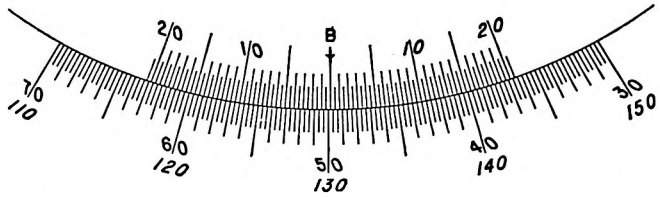
The figure reads 4° + 40′ = 4° 40′ from right to left.



Style B.

Style B represents the usual graduation of the horizontal limb of an Engineer's Transit with its vernier. This is an ordinary **double-direct vernier**, reading from the center, to either extreme division (30). The limb is graduated to half degrees, and the vernier (from 0 to 30) comprises 30 divisions; therefore, the reading of the vernier is 30 minutes ÷ 30 = 1 minute.

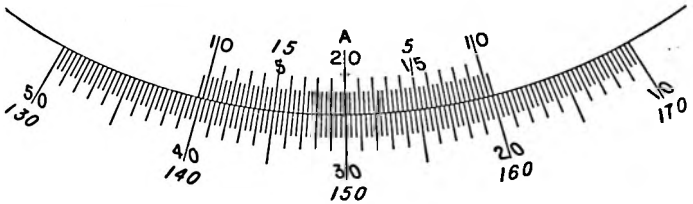
The figure reads 17° + 25′ = 17° 25′ from left to right, and 342° 30′ + 05′ = 342° 35′ from right to left.



Style C.

Style C represents the graduation and vernier of an Engineer's Transit having finer divisions than style B. This is also a **double-direct vernier**, reading from the center to either extreme division (20). The limb is graduated to 20 minutes and there are 40 divisions in the vernier; consequently, the reading of the vernier is 1200 seconds ÷ 40 = 30 seconds.

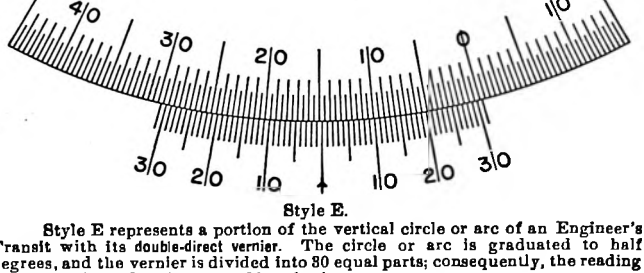
The figure reads 130° 00′ + 9′ 30″ = 130° 9′ 30″ from left to right, and 49° 40′ + 10′ 30″ = 49° 50′ 30″ from right to left.



Style D.

Style D represents part of the horizontal limb, with the vernier, of an Engineer's Transit having still finer divisions than those of style C. The vernier is a **folded** one, reading from the center, indicated by the arrow, to either of the extreme divisions (10), and then forward in the same direction from the other extreme division (10) to the center division (20), the direction being determined by the numbering and reading of the limb. The limb is graduated to 20 minutes, while the vernier is composed of 60 equal parts; consequently, the reading of the vernier is 1200 seconds ÷ 60 = 20 seconds.

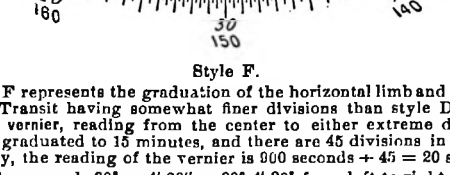
The figure reads 149° 40′ + 17′ 20″ = 149° 57′ 20″ from left to right, and 30° + 2′ 40″ = 30° 2′ 40″ from right to left.



Style E.

Style E represents a portion of the vertical circle or arc of an Engineer's Transit with its double-direct vernier. The circle or arc is graduated to half degrees, and the vernier is divided into 30 equal parts; consequently, the reading of the vernier is 30 minutes ÷ 30 = 1 minute.

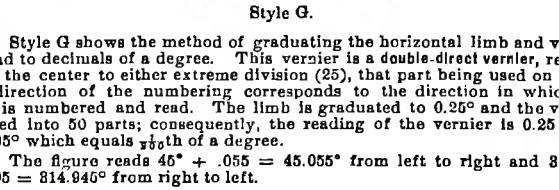
The figure reads 14° 30′ + 14′ = 14° 44′ from right to left.



Style F.

Style F represents the graduation of the horizontal limb and vernier of an Engineer's Transit having somewhat finer divisions than style D. This is a double-direct vernier, reading from the center to either extreme division (15). The limb is graduated to 15 minutes, and there are 45 divisions in the vernier; consequently, the reading of the vernier is 900 seconds ÷ 45 = 20 seconds.

The figure reads 30° + 4′ 20″ = 30° 4′ 20″ from left to right and 149° 45′ + 10′ 40″ = 149° 55′ 40″ from right to left.

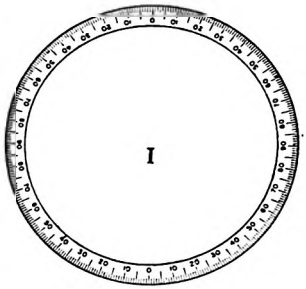


Style G.

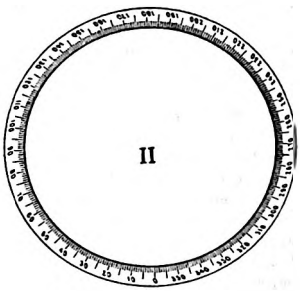
Style G shows the method of graduating the horizontal limb and vernier to read to decimals of a degree. This vernier is a double-direct vernier, reading from the center to either extreme division (25), that part being used on which the direction of the numbering corresponds to the direction in which the limb is numbered and read. The limb is graduated to 0.25° and the vernier divided into 50 parts; consequently, the reading of the vernier is 0.25 ÷ 50 = .005° which equals $\frac{1}{200}$th of a degree.

The figure reads 45° + .055 = 45.055° from left to right and 314.75° + .195 = 314.945° from right to left.

NUMBERING OF LIMBS.



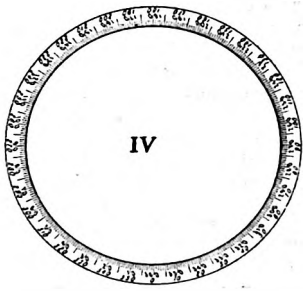
Vertical Circle,
numbered in quadrants.



Horizontal Limb,
numbered 0—360.



Horizontal Limb,
numbered 0—360,
and in quadrants.



Horizontal Limb,
numbered 0–360,
and 360—0.

The above illustrations show some of the various methods of numbering the graduations of the horizontal and vertical limbs of transits. Unless other methods of numbering are specified in the order, *we furnish our transits with the horizontal limb numbered double, in opposite directions, from 0 to 360° as in cut IV, and the vertical circle numbered in quadrants as in cut I*, which is the method of numbering usually preferred.

Verniers of the horizontal limbs are usually placed at an angle of 30° with the telescope, thus enabling the observer to read them without changing position. The vernier glasses, to avoid parallax, are set close to the graduation, and have hinged reflectors (diffusers) which can be set at any angle.

The **Compass Circle** is beveled to facilitate reading, and faced with *solid silver* to insure the accuracy and legibility of the graduations. This circle, unless otherwise ordered, is graduated to half degrees and numbered in quadrants from 0 to 90°.

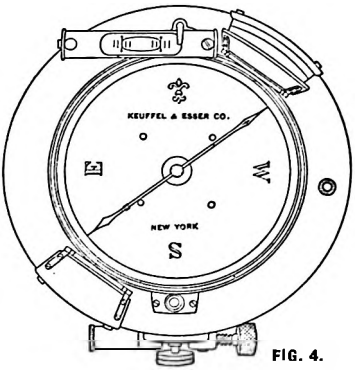


FIG. 4.

The Compass **Needle** has a distinctive shape, being bent upward at the ends to bring the points into closer coincidence with the graduations on the Compass Circle. It has a fine jeweled center. Comparison with needles of other construction has proven it to be of *superior accuracy and sensitiveness.* The north end is marked with an arrow ⟶, while the south end is weighted with a few turns of silver wire to compensate for the magnetic inclination (for the northern hemisphere). This wire can be shifted to compensate for changes in the inclination, which varies in different localities. Instruments are shipped adjusted for the inclination at New York. We adjust them free of charge for any other locality, if desired.*

Variation Plate. The setting off of the magnetic declination is effected by a graduated arc on the face of the compass box in conjunction with a vernier on the compass circle. The circle is rotated by means of a rack and capstan-head pinion conveniently located on the upper plate. For this adjustment we furnish a special non-magnetic adjusting pin of phosphor bronze; this prevents deflection of the needle, inevitable in the use of a steel pin. The capstan-head has an advantage over the ordinary thumb screw in that the variation when once set cannot be accidentally disturbed. *The compasses of all our transits are provided with this improved variation plate.*

To Remove the Compass Glass: The cover glass of the compass, which is held in place by an expanding ring, fits snugly and is sealed with soft cement, *to prevent the entrance of moisture.* This cement offers but slight resistance in removing the glass, which can be lifted off by means of a piece of wood or paper temporarily glued or cemented to it to serve as a handle.

A-shaped Standards. Our high-grade instruments are now built (see No. 5060, pp. 292.) with a straight ribbed A-shaped standard, remarkable for both lightness and strength. In order to obtain the high degree of strength peculiar to this new standard, the hard exterior crust is not removed from the casting, and all standards of this type are furnished with "morocco" finish only.

* After storing away a transit it is advisable to release the needle until it has assumed magnetic North and South; then clamp it. This tends to preserve the magnetism of the needle.

U shaped Standards. Our transits with U-shaped Standards (Fig. 5) are of improved patented construction. The standards are directly and rigidly mounted on the flange of the inner center and are essentially a part of it. The vital importance of this improvement is obvious, as it insures the greatest steadiness of the telescope. Standards of this type are always made with "morocco" finish.

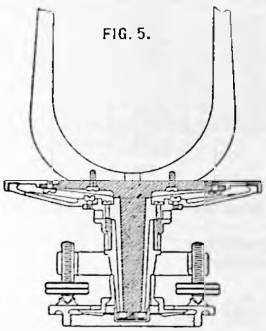


FIG. 5.

The Vertical Circle of our transits is usually graduated to read to single minutes, although finer graduations are regularly furnished with some of the larger instruments. Peripheral graduations are regularly furnished with our Wet Mine Transit; for other instruments they may be supplied to order.

Optical Glass. Inability to procure optical glass from Europe during the World War necessitated the establishment of our own Optical Glass Plant, where we manufacture with great success the various kinds of optical glass used in our telescope lenses. We can be justly proud of our achievement in this highly scientific line of development, which won for us the fullest approval of the U. S. Government and enabled us to complete, without outside assistance, the important orders for Fire control instruments (telescopes and periscopes), which were intrusted to us by the Army and Navy.

Telescope. All our telescopes are carefully designed by our optical research department to meet their specific purposes in the most effective manner. All our lenses are made of the finest optical glass, of correct index, carefully selected as free from striae and bubbles. All lenses, during manufacture and when finished, are rigidly inspected in our optical laboratory, which is equipped with the most modern apparatus for the testing of lenses and optical systems.

The magnification chosen for each instrument is that which our extensive experiments have shown to be the most practical in actual field use. We have found that excessive magnification is to be avoided, since it decreases the brightness of the image, lessens the field of view, and at the same time accentuates the vibration of the atmosphere.

The eyepieces supplied with our telescopes are either of the astronomical, (inverting) or terrestrial, (erecting) type. The terrestrial telescope shows objects in their right position, while the astronomical telescope shows the image inverted. The former is somewhat more convenient to use, but on the other hand, the latter has a clearer field. The inverting eyepiece is considerably shorter than the erecting, and allows a greater focal length for the objective, which is a great advantage, particularly for stadia work.

The cross hairs of our Preliminary Survey Transits and Builder's Transits and Levels are focused by the drawing out of the eye-piece tube. All other instruments with erecting eyepiece have our new improved focusing arrangement with resetting scale.

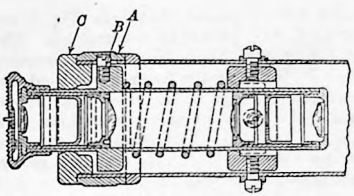


FIG. 6.

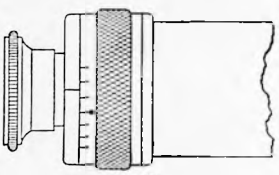


FIG. 7.

The construction of this improved ocular movement is shown in Figs. 6 and 7.

A is a knurled focusing ring with an inside spiral groove.
B is a screw securely attached to the eyepiece .
C is a locking collar.

Rotation of the knurled ring *A*, (see Fig. 6.), causes the screw *B* to traverse a longitudinal slot in the telescope body, and to move the eyepiece with it, to the desired position. The movement is strictly parallel to the telescope axis (in contrast to the well-known spiral movement).

To facilitate refocusing, a scale is engraved on the focusing ring with an index on the locking collar. See Fig. 7.

Stadia Hairs. The relation between the size and distance of an object and the size of its image in a telescope is given by the formula:-

$$\frac{Y^1}{Y} = \frac{f}{d} \quad , \quad or \quad d = \frac{f.Y}{Y^1}$$

Y denotes the linear size of the object, Y^1 that of its image (the distance of the stadia wires in this case), *f* the focal length of the objective and *d* the distance of the object (the rod) from the first principal focal point. This point lies in front of the objective at a distance nearly equal to its focal length. To reduce the measured distance *d* to the true distance *D* from the center of the instrument, add to *d* a constant equal to the distance of the first principal focal point from the center of the instrument.

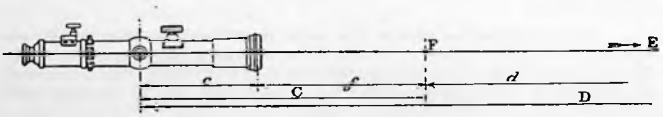


FIG. 8.

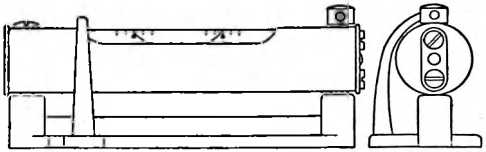
The stadia hairs in our transits are adjusted in the proportion:-

$\frac{Y^1}{f} = \frac{1}{100}$, i. e. to intercept one foot at a distance of 100 feet, or one meter at a distance of 100 meters, etc. This proportion reduces the above formula to the simple relation $d = 100\ Y$, to which must be added the constant (*C*) as explained. For example, assuming the stadia reading to be 1.37, the focal length (*f*) .62, and the distance from objective to center of the instrument .45, then the constant (*C*) would be equal to .62 + .45 = 1.07, and the total distance (*D*) would be (100 × 1.37) + 1.07 = 138.07. The value of this constant which is correct for distances beyond about 100 feet, is stated on the label in the box of each instrument provided with stadia hairs.

All our Transits, with the exception of the Builder's Transit, are now furnished with Stadia Hairs.

The **Level Vials** (spirit levels) are of special glass made for this purpose. They are ground to a true curve and contain a very mobile fluid which will *not form a sediment.* Our telescope level vials are larger than those usually employed. All our level vials are graduated on the glass to 2 mm., and are of a sensitiveness in keeping with the grade of the instrument. The graduation lines on the vial are black so that they can be easily distinguished, even in poor light. The Plate Level Vials are mounted on the plates by means of bubble holders provided with a strain-proof bubble adjustment, as shown in Fig. 9.

FIG. 9.



The new adjustment consists of an annular groove in the capstan-headed adjusting screw. The end of the bubble tube is milled out to receive a small phosphor bronze plate to which is riveted a small phosphor bronze pin. At its end this pin has a radius to fit that of the groove in the adjusting screw, and a longitudinal bearing surface of $\frac{1}{16}$". The phosphor bronze plate, being of a springy material, maintains a constant and uniform pressure against the adjusting screw; the plate is held in position by two screws so placed that the adjustment is not affected, and the adjusting screw is not injured.

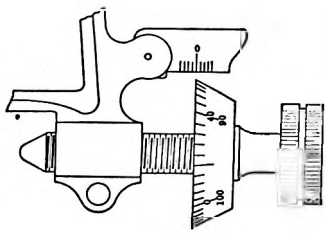
In order to avoid strain on the level mounting during adjustment of the plate level, the other end of the plate level is provided with an opening large enough to fit both the screw by which the level is attached to its base, and a phosphor-bronze spring around the screw. This spring acts as a cushion and allows considerable rocking of the plate level without strain on the mounting.

The Level Vials are ground to a proper curvature. Each is carefully tested on a level trier, to determine its sensitiveness (the angular value of one division on the vial) and uniformity of curvature.

We have found that ether filled levels are too readily affected by temperature changes, and therefore, have substituted a fluid which, while not open to that objection, meets every requirement.

It should be borne in mind that the accuracy of the results obtainable, if the instrument be well made in other respects, depends upon the sensitiveness of the level vials; results cannot be accurate if the bubble does not readily respond to the slightest change in adjustment. Coarse and sluggish level vials are easily brought into apparent adjustment, but the actual results obtained with them are very uncertain. Even when fine and sensitive vials seem to be a "little out", the actual results are far better than those obtained with sluggish level vials which seem to indicate perfect adjustment.

FIG. 10.



The **Gradienter Screw** is a modification of the telescope tangent screw, so designed as to elevate or depress the line of sight in accordance with any predetermined calculation. The silvered drum attached to the head of the screw is generally divided into 50 or 100 parts and the pitch of the screw and the length of the clamp arm so calculated that one unit of division on the screw head represents $\frac{1}{10}$ foot vertically at a horizontal distance of 100 feet. A graduated bar opposite the graduations on the drum indicates the number of complete revolutions of the Gradienter Screw.

THREE LEVELING SCREWS.

The four-screw instruments are the favorites of Engineers. They are compact, easy of attachment to the tripod, and readily leveled.

Three-screw instruments, however, are beginning to find increasing favor in engineering circles, as the three-screw leveling head as now constructed by us possesses many distinct advantages. Our three-screw transits have shifting plate and can be as readily mounted upon the tripod as the four screw instruments; moreover a higher degree of accuracy is attainable with three leveling screws than with four.

In the operation of these three-screw instruments it is necessary to manipulate only two of the leveling screws; the third acts as a fulcrum. One plate level is brought parallel to two screws; the other plate level will then be at right angles to them. Both plate levels are then leveled at once by turning one of the screws to which the first plate level is parallel and the screw which is at right angles to this plate level; the adjustment of the plate levels is then checked in the same manner as with a four leveling-screw instrument: i. e. the instrument is revolved 180° to determine whether the bubbles come back to the center.

A higher degree of accuracy is secured because the wider base of the three screw system permits full advantage to be taken of the sensitiveness of the levels with which these extra-fine instruments are equipped.

The highest-class Precision Levels and Triangulation Theodolites are always furnished with three leveling screws.

MOROCCO FINISH.

All our transits and levels with the exception of our Builder's Levels and Transits and Preliminary Survey Transits are furnished with our new Morocco finish. This black finish is applied to the castings, on which the scale has been allowed to remain for the sake of adding strength. The black color of the finish tends to equalize the temperature, thus eliminating strain due to sudden temperature changes. The dull black is not glossy nor glaring in sunlight and does not hurt the eye. The Moroco finish does not wear off so easily as other finishes.

LEVELS.

Two types of levels are in general use, the Y level and the Dumpy level.

THE Y LEVEL consists of a telescope to which a long spirit level is attached. The telescope rests on two uniformly turned collars in vertical supports, or Y's. The Y's are mounted at each end of a horizontal bar, which is firmly secured in the center to a vertical axis upon which the instrument may revolve.

The Center is made of hard bell metal, is extra long to give stability and accuracy, and is so constructed as to assure a steady and easy rotation even after long use. **The Leveling Head** is substantially built and its shape is such as to protect the center of the instrument from injury in case of a blow or the straining of the leveling screws. The four arms are slotted and provided with set screws to take up the wear of the leveling screws, and to provide against binding due to sudden changes of temperature. The leveling screws are very carefully cut on a precision lathe, thus insuring a thread which, on account of its smoothness and uniformity, gives long service. The shape of the leveling plate, furthermore, affords ample room to manipulate the leveling, clamp and tangent screws.

All clamp and tangent screws are conveniently located, and revolve with the telescope so that they constantly remain in the same relative position and are always equally accessible. The tangent screw is of very hard nickel silver; an opposing spring prevents lost motion.

Bar. The approximately triangular cross section of the new level bar of the Y level offers the least surface to wind pressure and accounts for the *unusual stability* of the instrument.

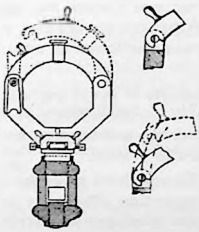


Fig. 11.

Y's. The Y's are strong and have an improved locking device (Fig. 11) instead of the usual pin bolts. They are provided with an improved stop by means of which the position of the telescope can be adjusted to have the cross hairs vertical and horizontal. This stop is adjusted by capstan-head screws and made to fold out of the way when the telescope is rotated. At the top of the inner side of the clips of the Y's is a little plunger with a spring. This plunger keeps an equal but light pressure upon the collar of the telescope. One of the Y's is capable of a slight vertical movement by means of double nuts.

The Telescopes vary from 13 to 21 inches in length. The details of their construction can be seen from the sectional view on page 332.

The Telescope has a rack and pinion movement to the objective, and our improved micrometer focusing arrangement with resetting scale for eyepiece, (see pages 271 and 272). The objective draw actuated by rack and pinion is constructed with great care and we guarantee the line of collimation to be correct for all distances.

The milled-headed focusing screw for the objective is placed on top of the telescope, conveniently accessible to either hand.

Collars. The collars on our high-grade levels are of bell metal. They are very carefully tested, to determine if they are parallel, cylindrical, and of equal diameters. Factory inspection is made on an apparatus which will detect an error of $\frac{1}{100,000}$ of an inch.

The Spirit Level attached to the telescope is long and sensitive, and its tube is of perfectly even curvature to insure equal angular value of the division unit throughout the whole length of the vial. See also page 273. The vials are graduated on the glass to 2 millimeters.

The tube is adjustable both vertically and horizontally, so that the instrument can be brought into perfect adjustment.

Precision Levels. For very accurate work we offer levels with three leveling screws, and in most cases, with inverting telescope. The three leveling screws facilitate the use of a sensitive bubble. The wider base gives greater rigidity and steadiness to the instrument. The inverting telescope renders the image more brilliant and, therefore, produces better definition. Through these advantages the accuracy of the result is enhanced.

For our three-screw Precision Levels, see page 284. For the Precision Level of the U. S. C. and G. S. pattern we use iron and steel wherever possible, as these materials have a lower coefficient of expansion and are more durable than any composition metal.

THE DUMPY LEVEL consists of fewer parts than the Y level, and is very compact, so that it is less liable to derangement in case of accident.

Telescope, spirit level, clamp and tangent screw, and leveling base are similar to those described for the Y level.

The tubular bar of the Dumpy level gives the instrument unusual rigidity and compactness, and at the same time effectually protects the level vial against accidental breakage and sudden temperature changes. The adjustment of the vial is accomplished by a single capstan-head screw beneath the bar.

BUILDER'S TRANSITS AND LEVELS.

(See pages 314, etc.)

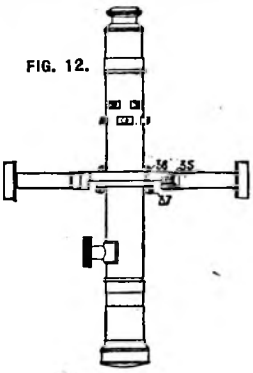
Our Builder's Transits and Levels meet the demand for well-made and durable instruments at very moderate prices. Builders and Architects will find these instruments very useful and convenient, simple to handle, and thoroughly adapted to the purposes for which they are particularly intended.

ARCHITECT'S CONVERTIBLE LEVELS.

(See pages 317, 318.)

Our **Architect's Convertible Levels**, through their patented arrangement, also can be used for sighting objects above or below the horizontal plane, and for sighting vertical lines. At the middle of the telescope there is a bearing piece with a threaded socket at each side, into which the strong trunnions can be screwed, to form a rigid axis at right angles to the telescope. The outer ends of the trunnions have bearing surfaces which fit into the Y's like the collars of the telescope. When they rest in the Y's, the telescope can be moved in altitude, so that vertical lines may be determined, as well as horizontal angles between two points not in the same plane. When the instrument is used as a Level, the trunnions are removed and placed in the box. Architects and Builders will find this patented arrangement very useful and well worth the extra cost.

FIG. 12.



FARM LEVELS.

These Instruments are designed for laying out parks, gardens and agricultural plots, draining, ditching, road making and similar uses which do not require the accuracy of an Engineer's Level.

PACKING OF INSTRUMENTS.

Our Levels and Transits are furnished with mahogany boxes, (except our Architect's and Farm Levels) in which they are accurately and securely fitted, and thus protected from injury. The boxes have a lock and key. Transit boxes also have safety hooks with patent catch and are provided with rubber bumpers. The boxes contain all accessories and tools specified in the description of each instrument. For sole leather carrying cases for any of our instruments, see page 328.

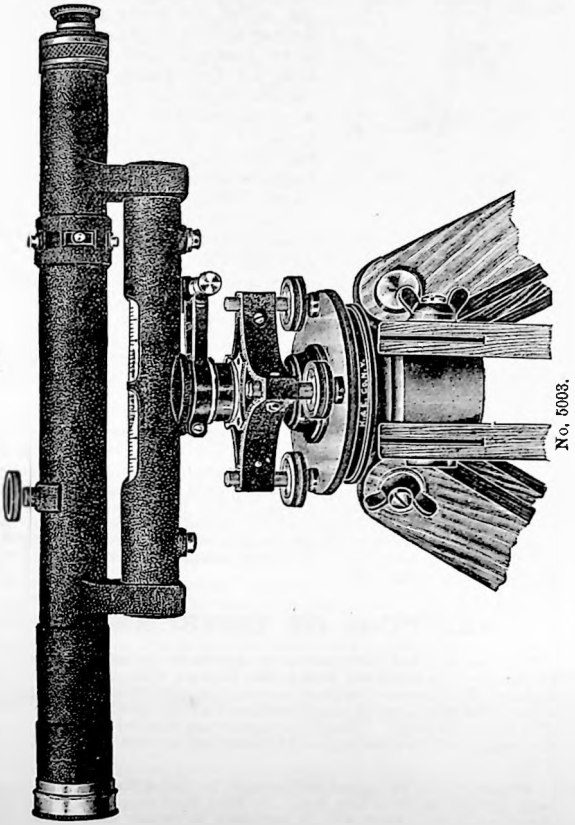
SHIPPING OF INSTRUMENTS.

When we ship our instruments by express we do not assume any responsibility after having delivered them to the Express Company. Their value is declared and the Express Company assumes the responsibility for the declared value including breakage, in consideration of a slightly higher rate than when the value is not declared. When instruments are shipped by freight we designate the contents of the package and the carriers assume liability for damage in transit.

NOTE. Instruments will be shipped to all points in the United States C. O. D. on approval, with privilege of three days trial. If, after three days trial, the instrument is found unsuitable, Agent will be instructed to refund money upon receipt of instrument in good condition.

EXTRA-FINE

ENGINEER'S DUMPY LEVEL.



No. 5008.

EXTRA-FINE

ENGINEER'S DUMPY LEVEL.

(See also general description, page 276.)

5003. Engineer's Dumpy Level.

Telescope 18 in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS 1⅜ in., focused by improved rack and pinion movement. EYEPIECE, erecting, with improved micrometer focusing arrangement with resetting scale. MAGNIFYING POWER 28 diameters.

Level Bar tubular in form, very strong, encasing fine spirit level. LEVEL VIAL graduated on the glass and ground to a sensitiveness of about 20 seconds of arc per graduation. Improved adjusting device for level vial. Very stout supports to telescope.

Center of gun metal, carefully fitted. Center and Level Bar are cast in one piece. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver. Four leveling screws.

Morocco Finish.

Instrument complete, with adjusting pins, waterproof cover, etc., in fine polished mahogany Box and with No. 5178N Split Tripod . . . . . each $

Weight of instrument about 9 lbs. Weight of tripod about 11 lbs.

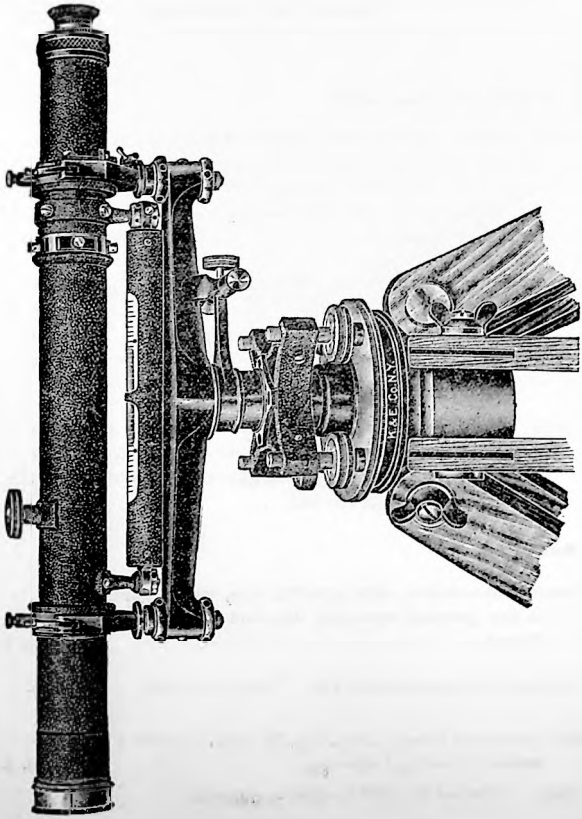
***5003A.** Engineer's Dumpy Level, like No. 5003, but with 15 in. astronomical (inverting) telescope . . . . . each $

***Note.** Instrument No. 5003 A, made to order only.

For other Dumpy Levels, see pages 314 and 319.

EXTRA-FINE

ENGINEER'S Y LEVEL.



No. 5010.

EXTRA-FINE

ENGINEER'S Y LEVELS.

(See also general description, page 275.)

5005. Engineer's Y Level.

Telescope 15 in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS $1\frac{5}{16}$ in., focused by improved rack and pinion movement. EYEPIECE, erecting, with improved micrometer focusing arrangement with resetting scale. MAGNIFYING POWER 24 diameters. Fine SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 20 seconds of arc per graduation. Level tube adjustable vertically and horizontally.

Level Bar of gun metal, improved construction, of great strength and rigidity, shaped to offer least resistance to the wind. One Y can be raised or lowered and is provided with an ADJUSTABLE HINGED STOP for placing the telescope with the cross hairs in a vertical and horizontal position. The Y's are locked by a patented arrangement dispensing with pinbolts.

Center of hard bell metal, carefully fitted. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver. Four leveling screws.

Morocco Finish.

Instrument complete with adjusting pins, waterproof cover, etc., in fine polished mahogany Box and with No. 5178N Split Tripod, ... each $

Weight of instrument about 9½ lbs.

Weight of tripod about 11 lbs.

5010. Engineer's Y Level, like No. 5005, but **telescope 18 in., object glass** $1\frac{3}{8}$ **in.**, MAGNIFYING POWER 28 diameters, with No. 5178N Split Tripod . . . . . each $

Weight of instrument about 11 lbs. Weight of tripod about 11 lbs.

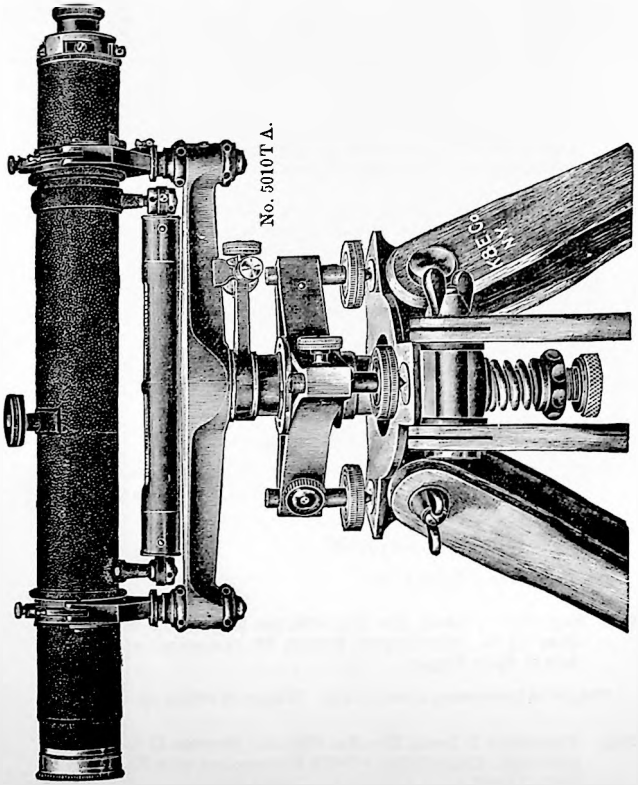
5012½. Engineer's Y Level, like No. 5005, but **telescope 21 in., object glass** $1\frac{5}{8}$ **in.**, MAGNIFYING POWER 32 diameters, with No. 5178N Split Tripod . . . . . each $

Weight of instrument about 13 lbs. Weight of tripod about 11 lbs.

EXTRA-FINE

ENGINEER'S Y LEVEL.

Three Leveling Screws.



EXTRA-FINE

ENGINEER'S Y LEVELS.

Three Leveling Screws.

(See also general description, page 275, etc.)

5005 TA. Engineer's Y Level, as described under No. 5005, but with 15 in. astronomical (inverting) TELESCOPE, and with three leveling screws.

Instrument complete, with extra-strong Split Tripod No. 5177 A. $

Weight of instrument about 10 lbs.

Weight of tripod about 13½ lbs.

5010 TA. Engineer's Y Level, as described under No. 5010, but with 18 in. astronomical (inverting) TELESCOPE, and with three leveling screws.

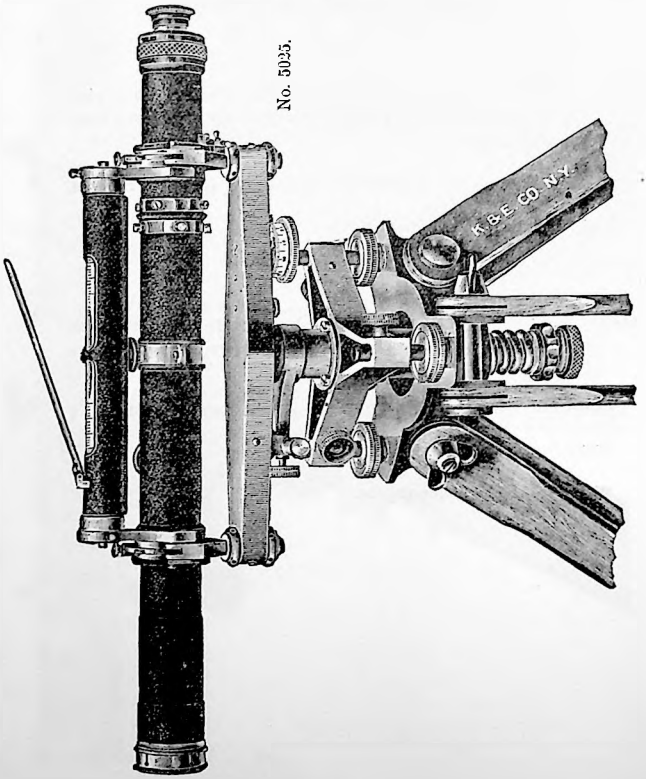
Instrument complete, with extra-strong Split Tripod No. 5177 A. $

Weight of instrument about 11½ lbs.

Weight of tripod about 13½ lbs.

K & E
PRECISION Y LEVEL

Three Leveling Screws.



K & E
PRECISION Y LEVEL

Three Leveling Screws.

5025. K & E Precision Y Level.

Telescope 18 in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS 1⅜ in., focused by improved rack and pinion movement. EYEPIECE erecting, with improved micrometer focusing arrangement with resetting scale. MAGNIFYING POWER 28 diameters. STADIA HAIRS fixed, ratio 1:100. Striding SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 10 seconds of arc per graduation. HINGED MIRROR, for observing level vial, mounted in aluminum.

Level Bar of gun metal, of great strength and rigidity. Within this bar is another bar rigidly attached to the center. The outer bar carrying the Y's is pivoted on the inner bar, its movement in altitude being controlled by a graduated micrometer screw and a strong counterspring. One Y, is adjustable for altitude and is provided with an adjustable HINGED STOP for placing the telescope with the cross hairs in a vertical and horizontal position. The Y's are locked by a patented arrangement dispensing with pin bolts. A circular spirit level for approximate leveling is placed at the right side of the leveling bar and may be observed by means of a reflector attached to it.

Center of steel, extra long, carefully fitted into the socket of the cast iron leveling head. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

Instrument complete, with adjusting pins, waterproof cover, etc., in fine polished mahogany Box and with strong Split Tripod No. 5177 A. . . . . $

Weight of instrument about 11½ lbs. Weight of tripod about 13½ lbs.

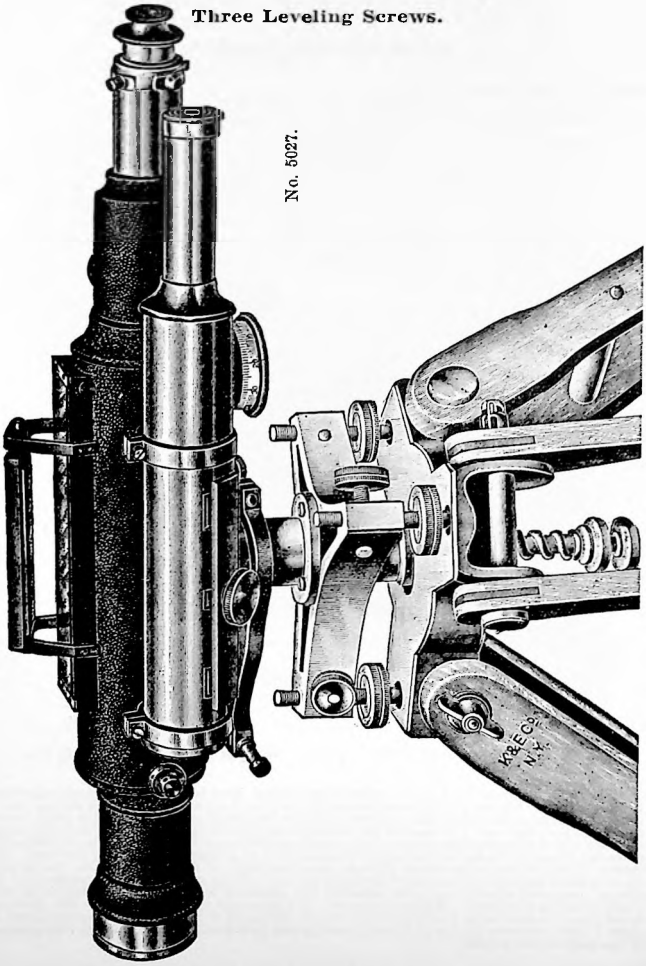
The K & E Precision Y Level, (3 leveling screws) is of highest-grade workmanship. It has extra-fine lenses, a very sensitive spirit level and an extra-long and strong steel center. It is so constructed that the level of the telescope is constantly under immediate control of the observer. The head of the micrometer screw is graduated and reads opposite an index which registers the number of revolutions of the screw. Two full revolutions will move the crosshair to the extent of 1 foot on a rod at a distance of about 100 feet. By means of this micrometer screw delicate re-adjustment of the level can be made for each sighting and the difference in level can be read off the same as with a gradienter. A mirror, mounted above the level, enables the observer to watch the bubble from his position at the eyepiece. Where the station is frequently changed or where the ground is not firm, the Precision Level will save much time and will give closer results than a plain Y level because the level of the telescope can be corrected for each sight by means of the micrometer screw.

PRECISION LEVEL.

(Made after the U. S. C. & G. Survey Level.)

Three Leveling Screws.

No. 5027.



PRECISION LEVEL.

Three Leveling Screws.

(Made after the U. S. C. & G. Survey Level)

5027. Precision Level, made after the U. S. C. & G. Survey Level.

Telescope 16 in., achromatic astronomical (inverting) with dust-cap and sunshade, improved rack and pinion movement. OBJECT GLASS 1¾ in. diameter. EYEPIECE with improved spiral focusing arrangement. Two eyepieces; MAGNIFYING POWER 36 and 42 diameters. STADIA HAIRS fixed, ratio 1:100. The telescope is mounted within a tubular support, at one end of which two pivot screws provide a horizontal axis about which the telescope can be moved in altitude and the line of collimation put into the horizon by means of a MICROMETER SCREW at the other end of the tubular support. The head of this micrometer screw is divided into 100 parts on a graduated ring. A lever handle raises the telescope off the micrometer screw and presses it against a spring sunk into the upper part of the tubular support to prevent jarring the telescope while the instrument is carried about.

Level to Telescope. The high-grade CHAMBERED level vial is placed in a recess of the telescope barrel. It is graduated on the glass and ground to a sensitiveness of about 2 seconds of arc per graduation. The level is observed by means of a device mounted in a tube placed alongside the telescope. It consists of a set of prisms so arranged as to reflect the image of the bubble to the eye of the observer. The prisms are adjustable for the length of the bubble, which varies with the temperature.

A circular spirit level for approximate leveling is placed at the right-hand side of the telescope support and may be observed by means of a reflector attached to it.

Center of steel, extra long, very carefully fitted into socket of cast iron leveling head. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

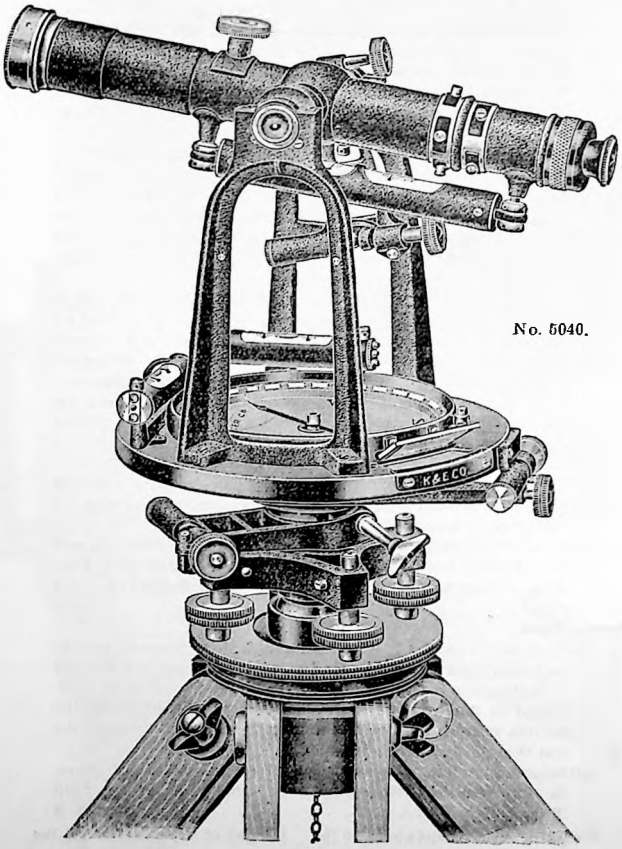
The level has an unusually long vertical axis, low center of gravity and small area exposed to wind pressure. These three features give it unusual stability under adverse field conditions. Stationed at the eyepiece end, the observer can easily see the bubble with his left eye at the same instant that he reads the rod through the telescope.

Instrument complete, with adjusting pins and waterproof cover, in fine polished mahogany Box and with strong Split Tripod, No. 5177A. . . . . each $

Weight of instrument about 15 lbs. Weight of tripod about 13½ lbs.

EXTRA-FINE

ENGINEER'S TRANSIT.



No. 5040.

EXTRA-FINE

ENGINEER'S TRANSIT.

For Synopsis of Transits, see page 324.

See also general description, page 284 etc.

5040. Engineer's Transit.

Telescope 11½ in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS $1\frac{5}{16}$ in., with improved rack and pinion movement. EYEPIECE with improved micrometer focusing arrangement with resetting scale. MAGNIFYING POWER 24 diameters. STADIA HAIRS fixed, ratio 1:100. Fine SPIRIT LEVEL to Telescope, graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring.

Horizontal Limb 6½ in. diameter, graduated on *solid silver* to half degrees and numbered like Fig. IV, page 269. Opposite double-direct VERNIERS at about 30° with telescope, reading to one minute. HINGED REFLECTORS. Two fine SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Compass. NEEDLE about 4½ in. COMPASS RING, beveled, graduated on *solid silver* to half degrees. VARIATION PLATE.

Centers, anti-friction composition, extra long and carefully fitted. FOUR LEVELING SCREWS. SHIFTING CENTER. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

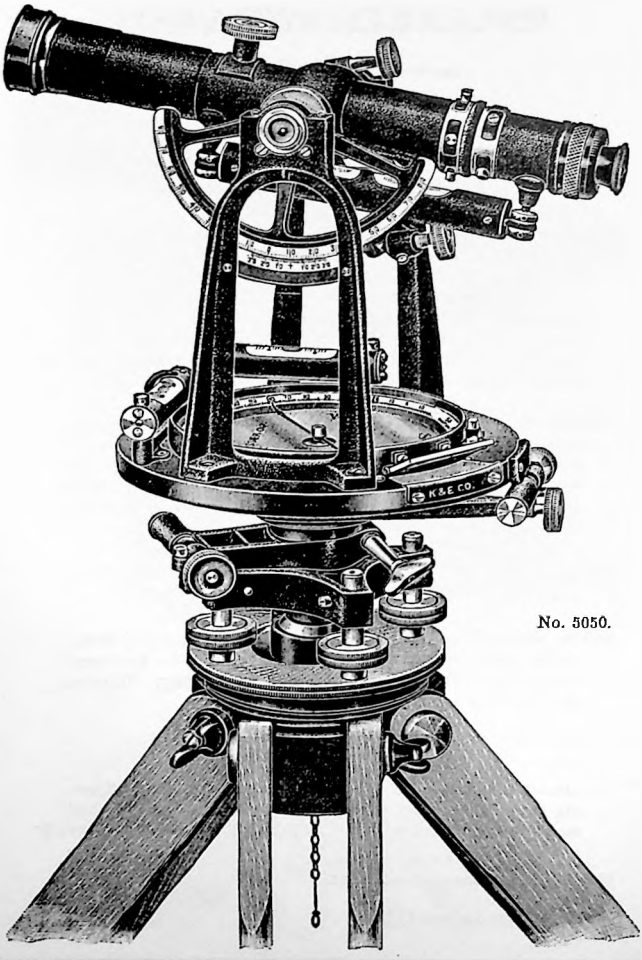
Instrument complete with plumb bob, magnifying glass, adjusting pins, waterproof cover, etc., packed in fine polished mahogany Box, and with No. 5178 N Split Tripod. . . . each $

Weight of instrument about 14 lbs.

Weight of tripod about 11 lbs.

For other graduations, see page 328.

EXTRA-FINE
ENGINEERS' TRANSIT
WITH VERTICAL ARC.



No. 5050.

EXTRA-FINE
ENGINEER'S TRANSIT
WITH VERTICAL ARC.

For Synopsis of Transits, see page 324.
See also general description, page 264 etc.

5050. Engineer's Transit.

Telescope 11½ in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS $1\frac{5}{16}$ in. with improved rack and pinion movement. EYEPIECE with improved micrometer focusing arrangement with resetting scale. MAGNIFYING POWER 24 diameters. STADIA HAIRS fixed, ratio 1:100. Fine SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring.

Horizontal Limb 6½ in. diameter, graduated on *solid silver* to half degrees and numbered like Fig. IV, page 269. Opposite double-direct VERNIERS at about 30° with telescope, reading to one minute. HINGED REFLECTORS. Two fine SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Compass. NEEDLE about 4½ in. COMPASS RING beveled, graduated on *solid silver* to half degrees. VARIATION PLATE.

Vertical Arc 5 in. diameter, graduated on *solid silver* to half degrees, double-direct vernier reading to one minute.

Centers, anti-friction composition, extra long, and carefully fitted. FOUR LEVELING SCREWS. SHIFTING CENTER. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

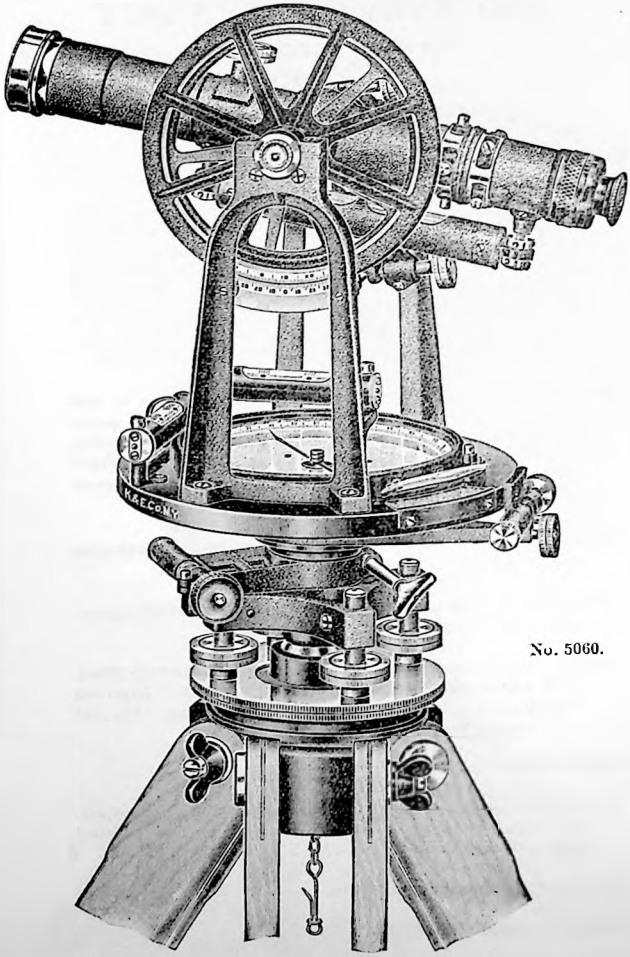
Instrument complete, with plumb bob, magnifying glass, adjusting pins, waterproof cover etc., packed in fine polished mahogany Box and with No. 5178 N Split Tripod. . . . . ℳ

Weight of instrument about 14½ lbs.

Weight of tripod about 11 lbs.

For other graduations, see page 328.

EXTRA-FINE
ENGINEER'S TRANSIT.



No. 5060.

EXTRA-FINE
ENGINEER'S TRANSIT
WITH VERTICAL CIRCLE.

For Synopsis of Transits, see page 324.
See also general description, page 284 etc.

5060. Engineer's Transit.

Telescope 11½ in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS $1\frac{5}{8}$ in. with improved rack and pinion movement. EYEPIECE with improved micrometer focusing arrangement with resetting scale. MAGNIFYING POWER 24 diameters. STADIA HAIRS fixed, ratio 1:100. Fine SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring.

Horizontal Limb 6½ in. diameter, graduated on *solid silver* to half degrees and numbered like Fig. IV, page 269. Opposite double-direct VERNIERS at about 30° with telescope, reading to one minute. HINGED REFLECTORS. Two fine SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Compass. NEEDLE about 4½ in. COMPASS RING, beveled, graduated on *solid silver* to half degrees. VARIATION PLATE.

Vertical Circle 5 in. diameter, graduated on *solid silver* to half degrees, double-direct VERNIER reading to one minute. GUARD to Circle.

Centers, anti-friction composition, extra long and carefully fitted. FOUR LEVELING SCREWS. SHIFTING CENTER. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

Instrument complete, with plumb bob, magnifying glass, adjusting pins, waterproof cover, etc., packed in fine polished mahogany Box, and with No. 5178 N Split Tripod. . . . . $

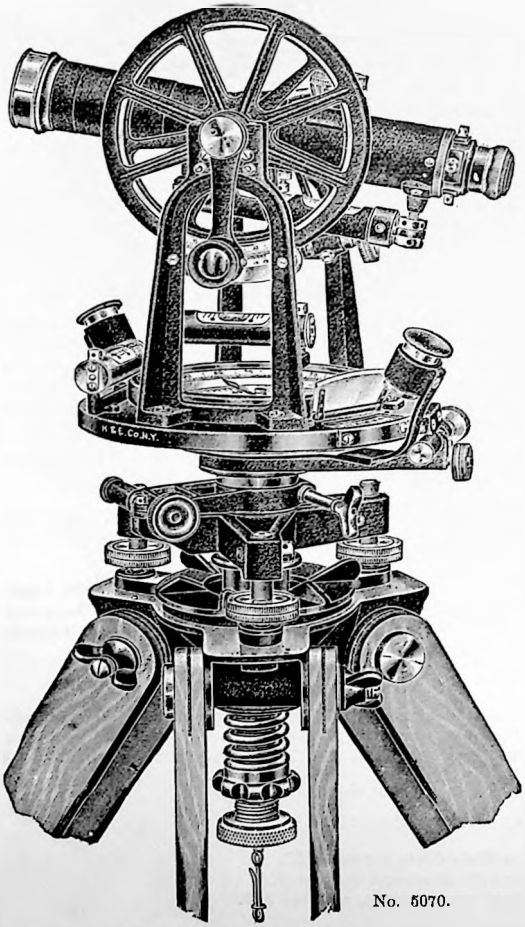
Weight of instrument about 15 lbs.

Weight of tripod about 11 lbs.

For Stadia Circle, see page 322.
For Solar Attachment, see page 312.
For other graduations, see page 328.

EXTRA-FINE
ENGINEER'S MOUNTAIN AND MINING TRANSIT.

Three Leveling Screws.



No. 5070.

EXTRA-FINE
ENGINEER'S MOUNTAIN AND MINING TRANSIT.

Three Leveling Screws.

5070. Engineer's Mountain and Mining Transit.

Telescope 9 in., achromatic astronomical (inverting) with dust cap and sunshade. OBJECT GLASS 1¼ in., with improved rack and pinion movement. EYEPIECE with spiral focusing arrangement with resetting scale, and adaptor for attaching prism. MAGNIFYING POWER 21 diameters. STADIA HAIRS fixed, ratio 1:100. Fine SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring. Telescope axis has center point for plumbing from overhead and is arranged to take Solar Attachment No. 5090.

Horizontal Limb 5½ in. diameter, graduated on *solid silver*, to 15 minutes and numbered like Fig. IV, page 269. Two opposite double-direct VERNIERS, reading to 20 seconds, placed at an angle of about 30° to the line of sight. MICROSCOPES to both Verniers. HINGED REFLECTORS. Two fine SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Compass. Needle about 4 in. COMPASS RING beveled, graduated on *solid silver* to half degrees. VARIATION PLATE.

Vertical Circle 4½ in. diameter, graduated on *solid silver* to 15 minutes, double-direct vernier reading to 20 seconds. MICROSCOPE to vernier. GUARD to Vertical Circle.

Centers, anti-friction composition, extra long and carefully fitted. THREE LEVELING SCREWS. SHIFTING CENTER. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

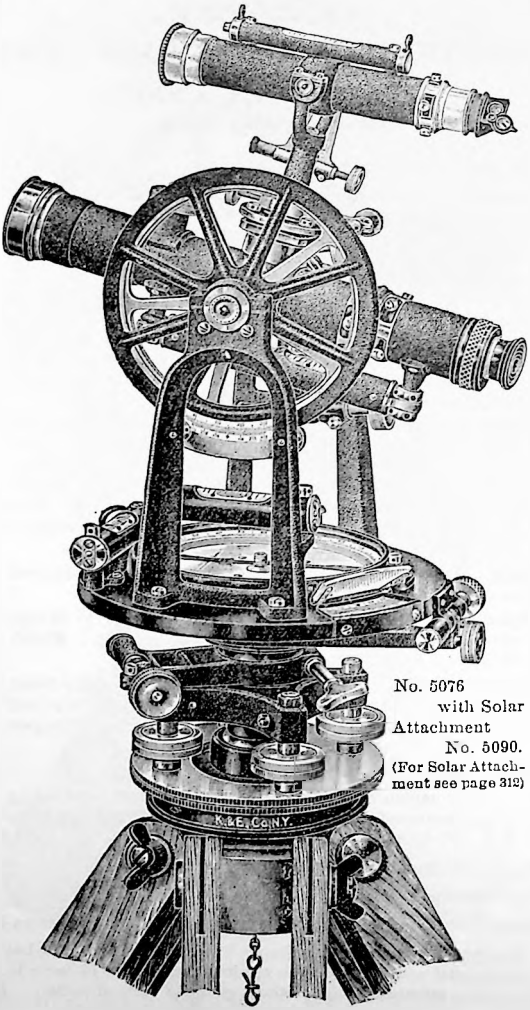
Instrument complete with plumb bob, magnifying glass, adjusting pins, waterproof cover, etc., packed in fine polished mahogany Box, and with Split Tripod, No. 5177B. . . . . $

Weight of instrument about 12½ lbs.

Weight of tripod about 14 lbs.

Special Extension Tripod inplace of Split Tripod . . . . . extra $

5071. Engineer's Mountain and Mining Transit, like No. 5070 but horizontal and vertical limb graduated to read to 30 seconds; without microscopes and without guard to vertical circle . . $



No. 5076
with Solar
Attachment
No. 5090.
(For Solar Attachment see page 312)

EXTRA-FINE
ENGINEER'S MOUNTAIN AND MINING TRANSITS.

For Synopsis of Transits, see page 324.

See also general description, page 264 etc.

5076. Engineer's Mountain and Mining Transit.

Telescope 9 in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS 1⅛ in., with improved rack and pinion movement. EYEPIECE with improved micrometer focusing arrangement with resetting scale. MAGNIFYING POWER 17 diameters. STADIA HAIRS fixed, ratio 1:100. Fine SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring. Telescope axis has center point for plumbing from overhead and is arranged to take Solar Attachment No. 5090.

Horizontal Limb 5½ in. diameter, graduated on *solid silver* to half degrees and numbered like Fig. IV, page 269. Two opposite double-direct VERNIERS at about 30° with telescope reading to one minute. HINGED REFLECTORS. Two fine SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Compass. NEEDLE about 4 in. COMPASS RING beveled, graduated on *solid silver* to half degrees. VARIATION PLATE.

Vertical Circle 4½ in. diameter, graduated on *solid silver* to half degrees, double-direct vernier reading to 1 minute. GUARD to Circle.

Centers, anti-friction composition, extra long and carefully fitted. FOUR LEVELING SCREWS. SHIFTING CENTER. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

Instrument complete with plumb bob, magnifying glass, adjusting pins, waterproof cover, etc., packed in fine polished mahogany Box, and with No. 5178 N Split Tripod . . . . . $

Weight of instrument about 11½ lbs.

Weight of tripod about 11 lbs.

***5074.** Engineer's Mountain and Mining Transit, as described under No. 5076, but with **Vertical Arc** of 4½ in. diameter, graduated on *solid silver* to half degrees, double-direct VERNIER reading to one minute. Instrument complete with No. 5178 N Split Tripod, etc. . . . . $

Weight of instrument about 11 lbs.

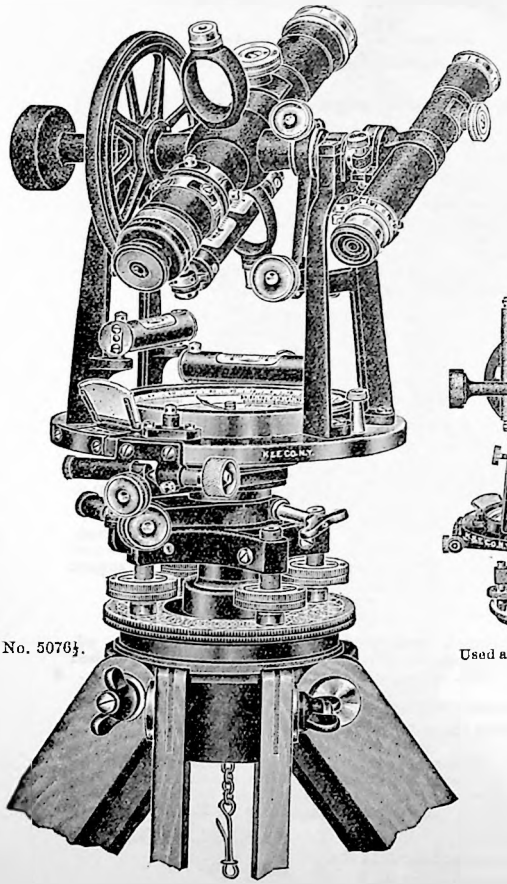
Weight of tripod about 11 lbs.

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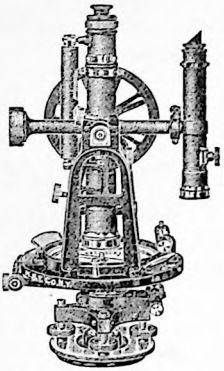
*NOTE. Instrument No. 5074 is made to order only.
For Extension Tripod No. 5180, see page 334.

EXTRA-FINE
ENGINEER'S MINING TRANSIT.

With Interchangeable Top and Side Telescope.



No. 5076½.



Used as Top Telecope.

Used as Side Telescope.

EXTRA-FINE
ENGINEER'S MINING TRANSIT
WITH INTERCHANGEABLE TOP AND SIDE TELESCOPE.

For Synopsis of Transits, see page 324.

See also general description, page 264 etc.

5076½. Engineer's Mining Transit with Interchangeable Top and Side Telescope.

Telescope 9 in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS 1¾ in., with improved rack and pinion movement. EYEPIECE with improved micrometer focusing arrangement with resetting scale. MAGNIFYING POWER 17 diameters. STADIA HAIRS fixed, ratio 1:100. Fine SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring.

Auxiliary Telescope 6½ in., achromatic astronomical (inverting), with dust cap. OBJECT GLASS ¾ in., with improved rack and pinion movement. EYEPIECE with spiral focusing arrangement. MAGNIFYING POWER 17 diameters. This auxiliary telescope for Vertical Sighting is attachable on one end or on top of the main telescope. Detachable counter weight. The upper post on the telescope axis has center point for plumbing from overhead.

Horizontal Limb 5½ in., diameter, graduated on *solid silver* to half degrees and numbered like Fig. IV, page 269. Two opposite double-direct VERNIERS at about 30° with telescope reading to one minute. HINGED REFLECTORS. Two fine SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Compass. NEEDLE about 4 in. COMPASS RING beveled, graduated on *solid silver* to half degrees. VARIATION PLATE.

Vertical Circle 4½ in. diameter, graduated on *solid silver* to half degrees, double-direct vernier reading to 1 minute. GUARD to Circle.

Centers, anti-friction composition, extra long and carefully fitted. FOUR LEVELING SCREWS. SHIFTING CENTER. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

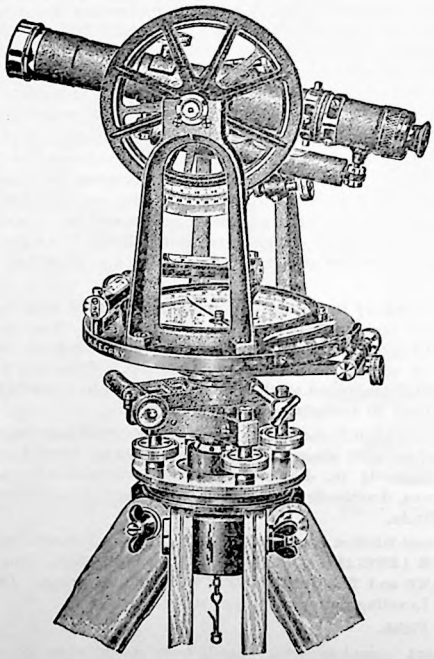
Instrument complete with plumb bob, magnifying glass, adjusting pins, waterproof cover, etc., packed in fine polished mahogany Box, and with No. 5178 N Split Tripod . . . . . $

Weight of instrument about 13 lbs.
Weight of tripod about 11 lbs.

For Stadia Circle, see page 322.

EXTRA-FINE

ENGINEER'S LIGHT MOUNTAIN TRANSIT.



No. 5077.

EXTRA-FINE
ENGINEER'S LIGHT MOUNTAIN TRANSIT.

For Synopsis of Transits, see page 324.
See also general description, page 264 etc.

5077. Engineer's Light Mountain Transit.

Telescope 8 in., achromatic terrestrial with dust cap and sunshade. OBJECT GLASS $1\frac{1}{8}$ in., with improved rack and pinion movement. EYEPIECE with improved micrometer focusing arrangement with resetting scale. MAGNIFYING POWER 15 diameters. STADIA HAIRS fixed, ratio 1:100. Fine SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring. Telescope has center point for plumbing from overhead and is arranged to take Solar Attachment No. 5090, (page 312).

Horizontal Limb $4\frac{3}{4}$ in. diameter. Graduated on *solid silver* to half degrees and numbered like Fig. IV, page 209. Opposite double-direct VERNIERS at about 30° with telescope, reading to one minute. HINGED REFLECTORS. Two fine SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Compass. NEEDLE about $3\frac{1}{4}$ in. COMPASS RING beveled, graduated on *solid silver* to half degrees. VARIATION PLATE.

Vertical Circle 4 in. diameter, graduated on *solid silver* to half degrees. DOUBLE DIRECT VERNIER reading to one minute. GUARD to Circle.

Centers, anti-friction composition, extra long and carefully fitted. FOUR LEVELING SCREWS. SHIFTING CENTER. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

Instrument complete, with plumb bob, adjusting pins, water-proof cover, etc., packed in fine polished mahogany Box, and with No. 5179 Split Tripod . . . . . $

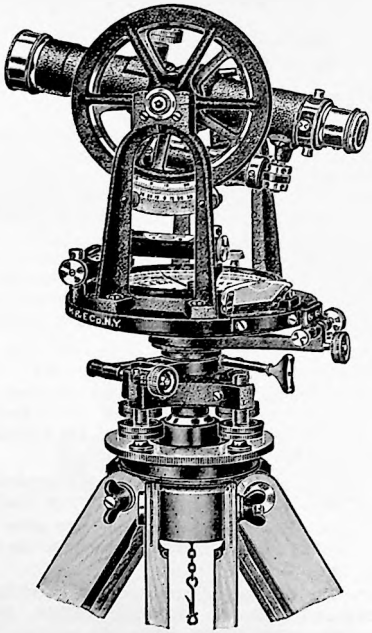
Weight of instrument about $9\frac{1}{2}$ lbs.

Weight of tripod about 7 lbs.

For other graduations,, see page 328.
For Solar Attachment, see page 312.
For Extension Tripod No. 5181, see page 334.

EXTRA-FINE

ENGINEER'S EXPEDITION TRANSIT.



No. 5079.



Leather covered Box with shoulder strap for transit No. 5079, and leather skeleton case with shoulder strap for tripod.

For sole-leather carrying cases for other transits, see page 328.

EXTRA-FINE

ENGINEER'S EXPEDITION TRANSIT.

For Synopsis of Transits, see page 324.

5079. Engineer's Expedition Transit.

Telescope 6½ in., achromatic astronomical, (inverting) with dust cap and sunshade. OBJECT GLASS ⅞ in., with improved rack and pinion movement. EYEPIECE with spiral focusing arrangement. MAGNIFYING POWER 14 diameters. STADIA HAIRS fixed, ratio 1:100. Fine SPIRIT LEVEL to telescope graduated on the glass and ground to a sensitiveness of about 35 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring.

Horizontal Limb 4 in. diameter, graduated on *solid silver* to half degrees and numbered like Fig. IV, page 269. Opposite VERNIERS at 30° with telescope, reading to one minute. HINGED REFLECTORS. Two fine SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 70 seconds of arc per graduation.

Compass. NEEDLE about 2¾ in. COMPASS RING beveled, graduated on *solid silver* to half degrees. VARIATION PLATE.

Vertical Circle 3½ in. diameter, graduated on *solid silver* to half degrees. Double-direct VERNIER reading to one minute. GUARD to Circle.

Centers, anti-friction composition, extra long and carefully fitted. FOUR LEVELING SCREWS. SHIFTING CENTER. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

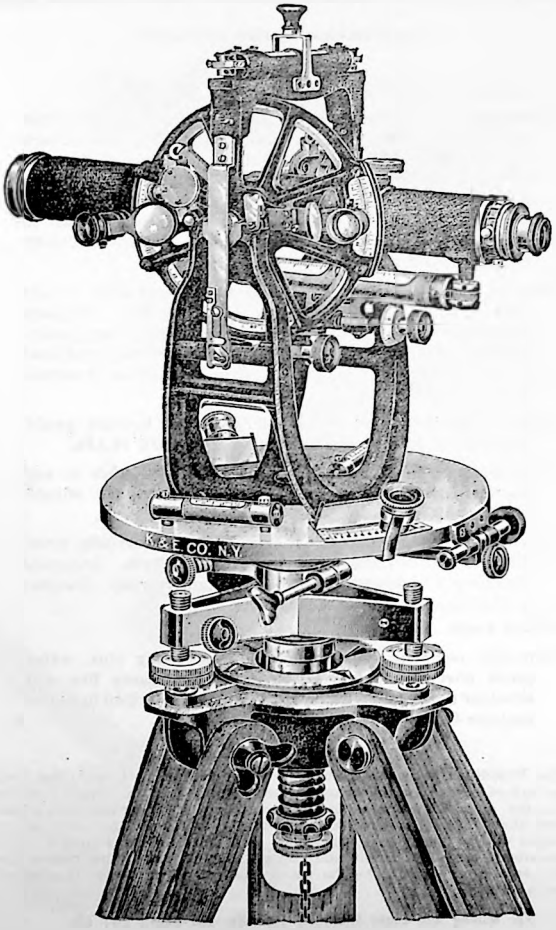
Instrument complete, with plumb bob, adjusting pins, waterproof cover, etc., fine **leather covered mahogany Box** with shoulder strap, and with No. 5183 Extension Tripod in leather skeleton Case . . . . . $

The Expedition Transit is of the same grade and quality as our finest Engineer's transits and of corresponding *accuracy*; the centers are 3 in. long. It is about 8¾ in. high, the outer diameter of the horizontal limb is 4¼ in. and its packing case measures about 11x8x6 in. outside. The complete transit weighs about 4½ pounds. The tripod can be extended to 59 inches and weighs about 4 pounds. With the leather-covered case for transit and Sling Case for tripod, this makes the most portable, *accurate* instrument for the many occasions when the combination of these features is of value.

For Mining and Light Mountain Transits, see pages 297 etc.

IMPROVED THEODOLITE.

Three Leveling Screws.



No. 5081.

IMPROVED
TRIANGULATION THEODOLITE.

Universal Instrument
Three Leveling Screws.

5081. Improved Theodolite with U-shaped Standards.

Telescope 14 in., achromatic astronomical (inverting), with dust cap and sunshade. OBJECT GLASS 1½ in. diameter with improved rack and pinion movement. TWO EYEPIECES, with spiral focusing arrangement. MAGNIFYING POWERS 24 and 32 diameters. STADIA HAIRS fixed, ratio 1:100. Fine REVERSIBLE SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 20 seconds of arc per graduation. STRIDING SPIRIT LEVEL to telescope axis, graduated on the glass and ground to a sensitiveness of about 20 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring.

Horizontal Limb, 8 in. diameter, graduated on solid silver to ten minutes. Opposite DOUBLE DIRECT VERNIERS at about 30° with telescope reading to ten seconds. MOUNTED MICROSCOPES to verniers. Two fine SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 40 seconds of arc per graduation.

Vertical Circle, 5½ in. diameter, graduated on solid silver to fifteen minutes. Opposite DOUBLE DIRECT VERNIERS reading to twenty seconds. GUARD to Circle. MOUNTED MICROSCOPES to verniers. Improved TANGENT SCREW with counterspring to vernier.

Centers, anti-friction composition, extra long and carefully fitted. U-shaped Standards mounted directly on flange of inner center (patented). THREE LEVELING SCREWS. SHIFTING PLATE. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

Instrument complete, with plumb bob, adjusting pins, etc., packed in two fine polished mahogany Boxes, and with fine Split Tripod, No. 5177B . . . . . $

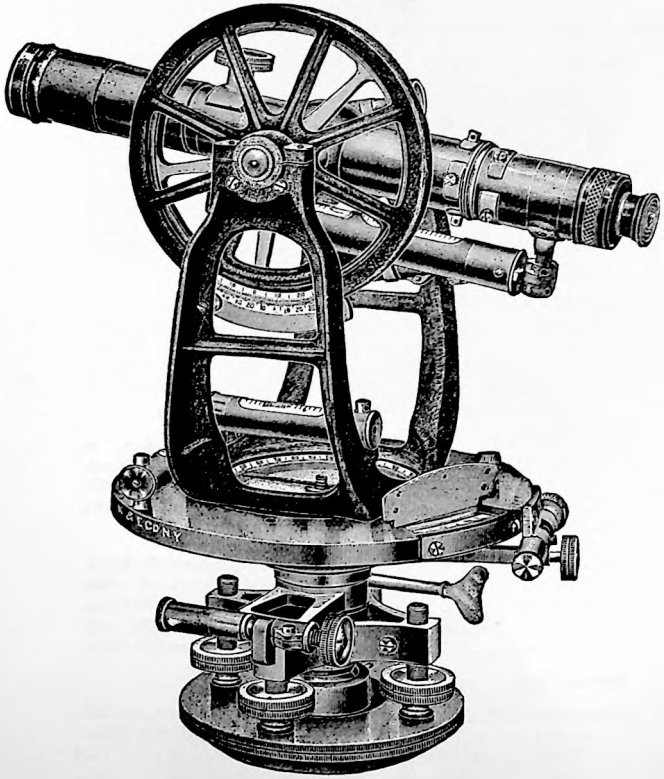
Weight of instrument about 21½ lbs.

Weight of tripod about 14 lbs.

K & E

IMPROVED TRANSIT

With U-shaped Standards and with Compass.



No. 5085 C.

K & E
IMPROVED TRANSIT
With U-Shaped Standards and with Compass.

For Synopsis of Transits, see page 324.

***5082 C.** Improved Transit with Compass.

Telescope 11½ in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS $1\frac{5}{16}$ in., with improved rack and pinion movement. EYEPIECE with improved micrometer focusing arrangement with resetting scale. MAGNIFYING POWER 24 diameters. STADIA HAIRS fixed, ratio 1:100. Fine SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring.

Horizontal Limb 6½ in. diameter, graduated on *solid silver* to half degrees and numbered like Fig. IV, page 269. Opposite double-direct VERNIERS, set at about 30° with telescope, reading to one minute. HINGED REFLECTORS. Two fine SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Compass. NEEDLE about 3 in. COMPASS RING beveled, graduated on *solid silver* to half degrees. VARIATION PLATE.

Centers, anti-friction composition, extra-long, and carefully fitted. U-shaped Standards, mounted directly on flange of the inner center (patented). FOUR LEVELING SCREWS. SHIFTING CENTER. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Morocco Finish.

Instrument complete with plumb bob, magnifying glass, waterproof cover, adjusting pins, etc., packed in fine polished mahogany Box, and with No. 5178 N Split Tripod . . . . . $

Weight of instrument about 15 lbs.

Weight of tripod about 11 lbs.

5084 C. Improved Transit with Compass as described under No. 5082 C, but with Vertical Arc of 5 in. diameter, graduated on *solid silver* to half degrees, double-direct VERNIER reading to one minute. Instrument complete, with No. 5178 N Split Tripod, etc. . . . . $

Weight of instrument about 15½ lbs.

Weight of tripod about 11 lbs.

5085 C. Improved Transit with Compass as described under No. 5082 C, but with full Vertical Circle 5 in. diameter, graduated on *solid silver* to half degrees, double-direct VERNIER reading to one minute. GUARD to Circle. Instrument complete, with No. 5178 N Split Tripod, etc. . . . . $

Weight of instrument about 16 lbs.

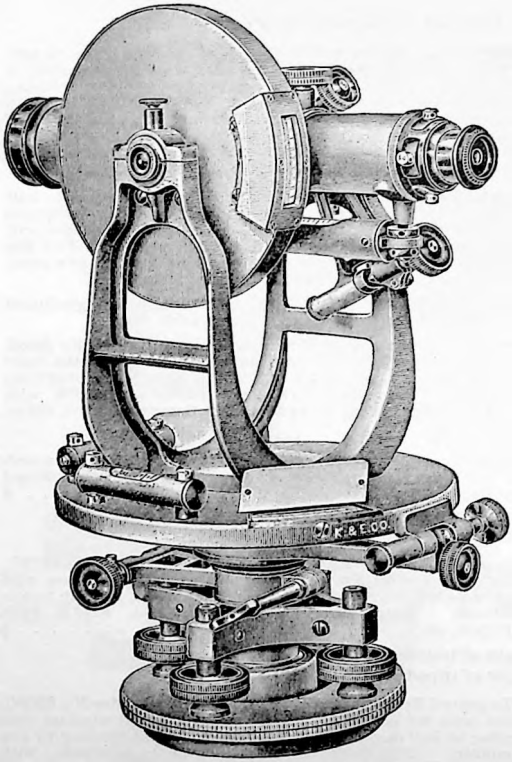
Weight of tripod about 11 lbs.

***Made to order only.**

For other graduations, see page 328.

EXTRA-FINE

ENGINEER'S WET MINE TRANSIT.



No. 5085 W. M.

EXTRA-FINE

ENGINEER'S WET MINE TRANSIT.

For Synopsis of Engineer's Transits, see page 324.

This instrument is so constructed that horizontal and vertical circles are protected from mine water.

***5085 W.M.** Engineer's Wet Mine Transit.

Telescope 9 in., achromatic astronomical (inverting), with dust cap and sunshade. OBJECT GLASS 1¼ in with improved rack and pinion movement. EYEPIECE with spiral focusing arrangement. MAGNIFYING POWER 17 diameters STADIA HAIRS fixed, ratio 1: 100. Fine SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 80 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring.

Horizontal Limb 5½ in. diameter, graduated on *solid silver* to half degrees and numbered like Fig. IV, page 269 Opposite VERNIERS, at about 80° with telescope, reading to one minute. HINGED REFLECTORS. Two fine SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Vertical Circle fully encased; with PERIPHERAL GRADUATIONS, on *solid silver* to half degrees, reading by vernier to one minute.

Centers, anti-friction composition, extra long, and carefully fitted. FOUR LEVELING SCREWS. SHIFTING CENTER. Improved CLAMP and TANGENT SCREW with counterspring. Tangent and Leveling Screws of nickel silver.

Smooth Enamel Finish.

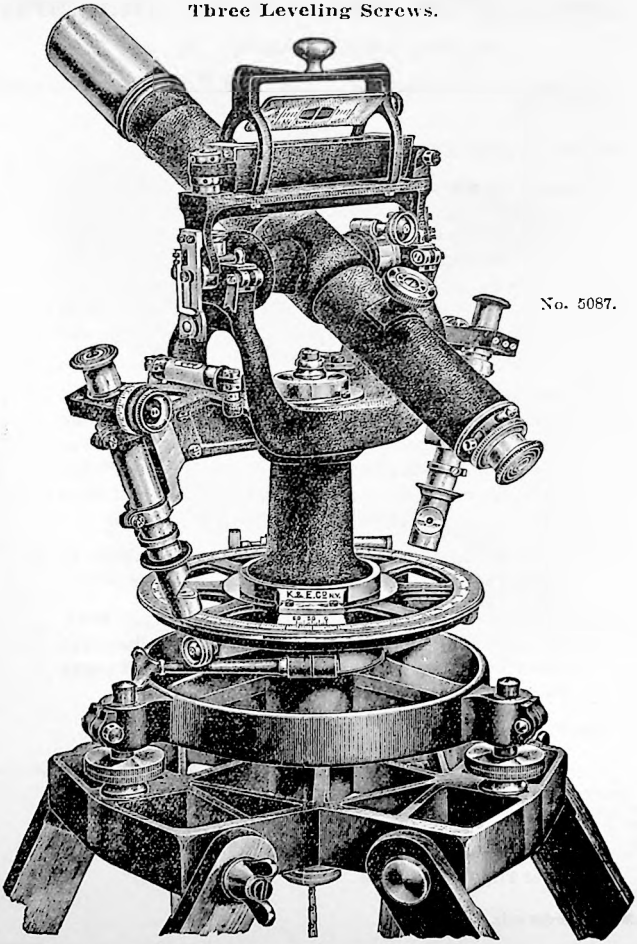
Instrument complete, with plumb bob, adjusting pins, waterproof cover, etc., packed in fine polished mahogany Box, and with No. 5178 N Split Tripod. . . . . $

Weight of instrument about 12 lbs.
Weight of Tripod about 11 lbs.

*Made to order only.

K & E
TRIANGULATION INSTRUMENT.

Three Leveling Screws.



No. 5087.

K & E
TRIANGULATION INSTRUMENT

For High-Class Triangulation Work.

Three Leveling Screws.

5087. Precision Theodolite for Triangulation and Repeating Angles.

Telescope 16 in. achromatic astronomical (inverting), with dust cap and sunshade. OBJECT GLASS 1 7/8 in., with improved rack and pinion movement. TWO EYEPIECES with spiral focusing arrangement. MAGNIFYING POWERS 24 and 38 diameters. Strong telescope axis with STEEL TRUNNIONS in wide bearings with patent locking device. Fine STRIDING SPIRIT LEVEL, in glass covered trough, graduated on the glass and ground to a sensitiveness of about 10 seconds of arc per graduation. REFLECTING MIRROR for observing spirit level. Improved CLAMP and TANGENT SCREW with counterspring.

Horizontal Limb 8 in. diameter, graduated on solid silver to five minutes. Opposite FILAR MICROMETER MICROSCOPES reading to five seconds, rigidly mounted and so adjusted that one full turn of the screw covers one division of the horizontal limb. INNER CIRCLE, for approximate setting, graduated to read by VERNIER to five minutes. Fine SPIRIT LEVEL graduated on the glass, and ground to a sensitiveness of about 40 seconds of arc per graduation.

Centers compound. Inner center STEEL. Column bearing telescope is a heavy ribbed U-shaped casting. THREE LEVELING SCREWS. Improved CLAMP and TANGENT SCREW with counterspring. Clamp and Tangent Screws of nickel silver. Leveling Screws of steel. Three foot plates for leveling screws.

Morocco Finish.

Instrument complete, with improved sunshade with reflector, plumb bob, adjusting pins, waterproof cover, etc., packed in two fine polished mahogany Boxes and with very strong Split Tripod . . . . . $

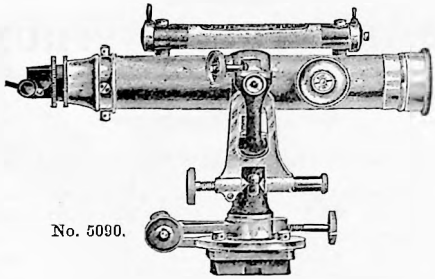
Weight of transit about 34 lbs.

Weight of tripod about 28 lbs.

***5087 B.** K & E Triangulation Instrument as described under No. 5087, but with horizontal limb 10 in. diameter, ... $

***Made to order only.**

SOLAR ATTACHMENT.



No. 5090.

5090. Solar Attachment, Bronze and Aluminum, achromatic astronomical (inverting) telescope 5¼ in., object glass 1⅜ in., with prism and colored glass. Magnifying Power 12 diameters. Morocco-finished standard, (price includes mounting, if ordered with transit) . . . . . $

Transits Nos. 5070, 5071, 5076, and 5077 are provided with screws for attaching No. 5090 This Solar Telescope can be furnished with any of our other transits except 5079. It can also be attached to old transits at a reasonable cost.

Astronomical meridian, latitude and time may be obtained with this Solar Attachment with great accuracy by a simple operation explained below. It **serves also as vertical sighting telescope,** making a valuable addition for mine work, etc.

It consists of a small telescope with prism to eyepiece, mounted in a Y-shaped standard which revolves upon a vertical axis attached on top of the telescope of the transit. This small telescope, called the solar telescope, is capable of rotation in altitude and azimuth, slow motion being imparted to it in either direction by means of tangent screws. The vertical axis, called the polar axis, can be inclined to correspond with the axis of the earth's rotation by inclining the transit telescope to which it is attached, the vertical limb giving the inclination. A spirit level which surmounts the solar telescope is provided with two pointers, so placed that when the shadow of one of them falls upon the other, the sun will be in the field of view.

DIRECTIONS FOR DETERMINING THE MERIDIAN.*

1. Incline the transit telescope until the angle of declination, corrected for refraction, is indicated by the vertical circle or arc, depressing the telescope if the sun's declination is north, and elevating it if it is south. See Fig. 1.

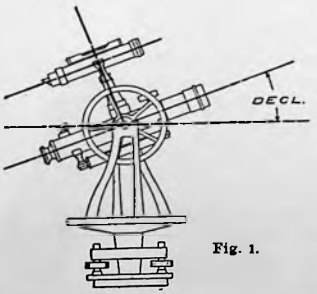


Fig. 1.

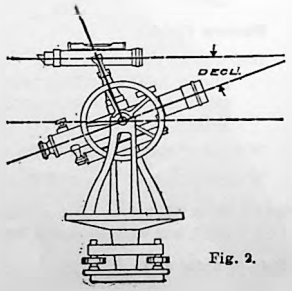


Fig. 2.

*For Tables see our annual publication "Solar Ephemeris and other Tables and Data useful to the Surveyor."

KEUFFEL & ESSER CO. NEW YORK

2. Bring the solar telescope into the vertical plane of the transit telescope, (without disturbing the position of the latter) and also to a horizontal position by means of its level. The two telescopes will now enclose an angle equal to the amount of the declination. See Fig. 2.

3. Without disturbing the relative positions of the two telescopes, elevate the transit telescope (and with it the solar) until the amount of the co-latitude is indicated by the vernier of the vertical circle. See Fig. 3.

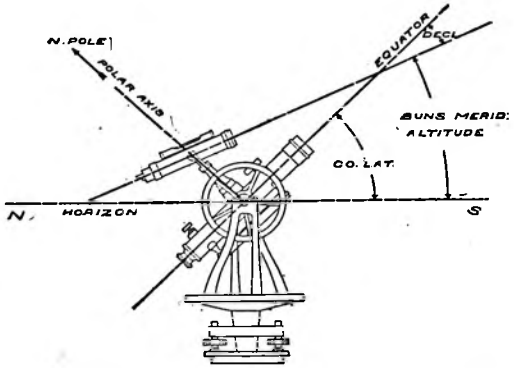


Fig. 3.

4. Revolve the transit on its vertical axis, and the solar apparatus about its polar axis (taking care not to revolve either telescope on its horizontal axis) until the image of the sun is brought into the field of the solar telescope; when the sun is accurately bisected the transit telescope will be in the meridian and the compass needle will indicate the amount of its declination at the place of observation. It will of course considerably facilitate this last operation if, before commencing to revolve the two telescopes, the transit one is approximately pointed toward the south by means of the transit compass needle.

DIRECTIONS FOR ASCERTAINING THE LATITUDE.*

Direct the transit telescope towards the south, incline it to an amount equal to the sun's meridian declination uncorrected for refraction, depressing the telescope if the declination is north and elevating it if it is south. Now bring the solar telescope into the vertical plane of the transit telescope and to a perfectly horizontal position by means of its level, then clamp it. A few minutes before apparent noon (the moment of the sun's culmination) bring the sun's image between the two horizontal wires of the solar telescope by moving *only* the *transit telescope* in altitude and azimuth. By means of the tangent screws of the transit, keep the sun, as it continues to rise and travel southwards, in this position relative to the cross hairs of the solar telescope. When it has ceased to rise, take the reading of the vertical arc of the transit, deduct from it the refraction due to this altitude, and the remainder is the co-latitude, which deducted from 90° gives the latitude. The position of the two telescopes is identical with that shown in Fig. 2.

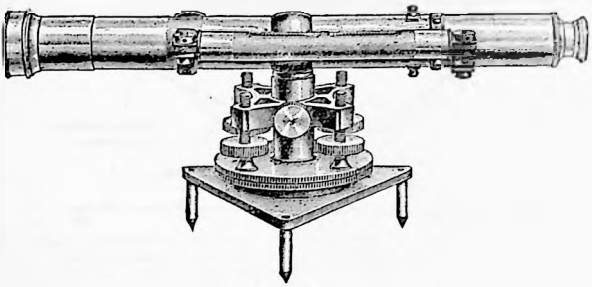
OBSERVATION FOR TIME.*

Having brought the two telescopes into their final positions for determining the meridian, that is the transit one in the meridian and the solar telescope bisecting the sun, revolve each one upon its *horizontal* axis, without disturbing the vertical axis, until they are both perfectly level. The angle formed by their respective lines of sight, which can be determined by sighting with the two telescopes upon any clearly defined distant object, and taking the difference of the respective readings of the transit horizontal limb, is the hour angle. This is then reduced to time before or after apparent noon: 1 degree of arc = 4 minutes of time and 1 minute of arc = 4 seconds of time. The time obtained by such an observation is reliable to a few seconds.

*SOLAR EPHEMERIS.

We publish annually a Solar Ephemeris, vest pocket size, containing those data from the Nautical Almanac which are used in solar and polaris observations. Included are many other astronomical tables compiled by us for the convenience of our customers; also a treatise on the more important surveying instruments and the methods of adjusting them. We have also added a discussion of the problems of field astronomy; logarithms of numbers up to 1000; natural values of functions; logarithms of functions; trigonometric formulas, etc. This valuable and unique booklet we furnish free of charge.

ARCHITECT'S DUMPY LEVEL.



No. 5107.

5107. Architect's Dumpy Level. An excellent instrument for work which does not require very great accuracy, such as ditching, draining, road leveling, etc.

Telescope 11 in., achromatic terrestrial, with dust cap and sun-shade. OBJECT GLASS 1¼ in., with improved rack and pinion movement. EYEPIECE with sliding adjustment for focusing cross hairs. MAGNIFYING POWER 18 diameters. SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 75 seconds of arc per graduation. CLAMP SCREW. FOUR LEVELING SCREWS. Gun metal finish.

Instrument complete, with metal trivet, plumb bob, etc., in strong Box, and with No. 5176 hardwood Tripod. . . . . $

Weight of instrument about 3 lbs.

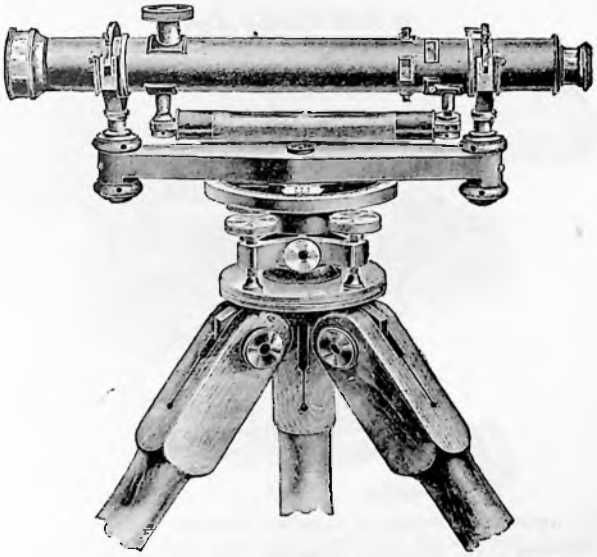
Weight of tripod about 6¼ lbs.

For Extra-fine Engineer's Dumpy Levels, see page 278.

For Railroad Dumpy Level, see page 319.

We have the best facilities for repairing Surveying Instruments of any make promptly and satisfactorily.

ARCHITECT'S Y LEVEL.



No. 5110.

5110. Architect's or Builder's Y Level. A most serviceable and compact instrument.

Telescope 11 in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS 1¼ in., with improved rack and pinion movement. EYEPIECE with sliding adjustment for focusing cross hairs. MAGNIFYING POWER 18 diameters. SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Level Bar of gun metal. Y's fitted with patent locking arrangement dispensing with pin bolts.

Horizontal Limb 3 in. diameter, graduated to degrees with VERNIER reading to 5 minutes. CLAMP SCREW. FOUR LEVELING SCREWS.

Gun Metal Finish.

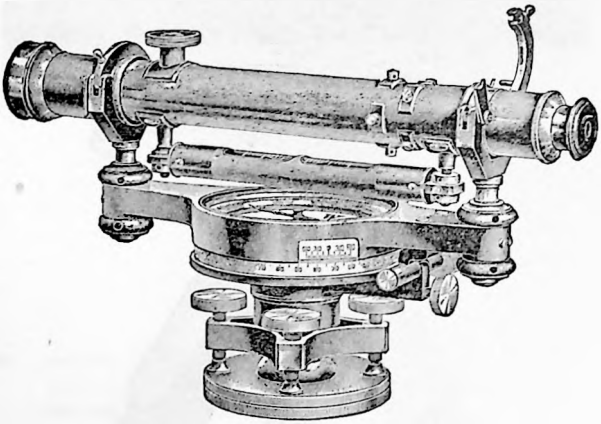
Instrument complete, with metal trivet, plumb bob, adjusting pins, and directions, in strong Box and with No. 5176 hardwood Tripod. $
Weight of instrument about 5 lbs. Weight of tripod about 6½ lbs.

5111. Architect's or Builder's Y Level, like No. 5110, but with improved **Clamp** and **Tangent Screw** with counterspring. . . . . $

For Extension Tripod No. 5182, see page 334.

ARCHITECT'S Y LEVEL

WITH COMPASS.



No. 5113.

5113. Architect's or Builder's Y Level with Compass.

Telescope 11 in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS 1¼ in., with improved rack and pinion movement. EYEPIECE with sliding adjustment for focusing cross hairs. MAGNIFYING POWER 18 diameters. SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Level Bar of gun metal. Y's fitted with patent locking arrangement dispensing with pin bolts.

Compass Needle about 3 in. long. Circle divided on raised ring to degrees.

Horizontal Limb 3¾ in. diameter, graduated to degrees with VERNIER reading to 5 minutes. Improved CLAMP and TANGENT SCREW with counterspring. FOUR LEVELING SCREWS.

Gun Metal Finish.

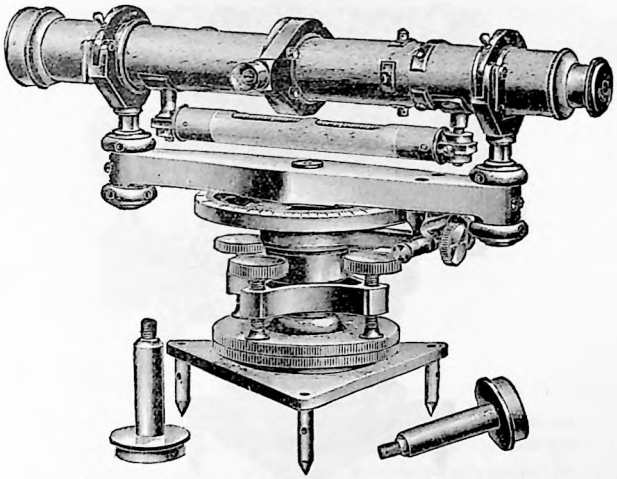
Instrument complete, with metal trivet, plumb bob, adjusting pins, and directions, in strong Box, and with No. 5170 hardwood Tripod . . . . . $

Weight of instrument about 6 lbs.

Weight of tripod about 6½ lbs.

For Extension Tripod No. 5182, see page 334.

ARCHITECT'S CONVERTIBLE Y LEVEL.



No. 5115. (Sighting a Horizontal Line; telescope in Y's, trunnions detached.)

5115. Architect's Convertible Y Level.

Telescope 11 in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS 1¼ in., with improved rack and pinion movement. EYEPIECE with sliding adjustment for focusing cross hairs. MAGNIFYING POWER 18 diameters. SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Level Bar of gun metal. Y's fitted with patent locking arrangement dispensing with pin bolts.

Horizontal Limb 3 in. diameter, graduated to degrees with VERNIER reading to 5 minutes. Improved CLAMP and TANGENT SCREW with counterspring. FOUR LEVELING SCREWS.

Extra Removable Axis to adapt telescope to sighting vertical lines.

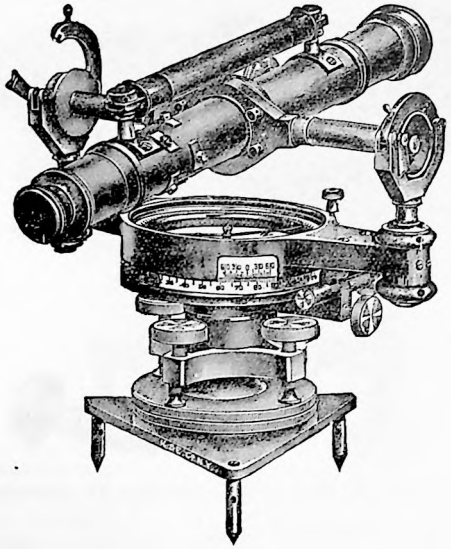
Gun metal finish.

Instrument complete, with metal trivet, plumb bob, directions, etc., in strong Box, and with No. 5176 hardwood Tripod. . . . . $

Weight of instrument about 6 lbs. Weight of tripod about 6½ lbs.

For Extension Tripod No. 5182, see page 334.

ARCHITECT'S CONVERTIBLE Y LEVEL WITH COMPASS.



No. 5117. (Sighting a Vertical Line; trunnions in Y's.)

5117. Architect's Convertible Y Level with Compass.

Telescope 11 in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS $1\frac{1}{8}$ in., with improved rack and pinion movement. EYEPIECE with sliding adjustment for focusing cross hairs. MAGNIFYING POWER 18 diameters. SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Level Bar of gun metal. Y's fitted with patent locking arrangement dispensing with pin bolts.

Compass Needle about 3 in. long. Circle divided on raised ring to degrees.

Horizontal Limb $3\frac{3}{4}$ in. diam., divided to degrees with VERNIER reading to 5 minutes. Improved CLAMP and TANGENT SCREW with counterspring.

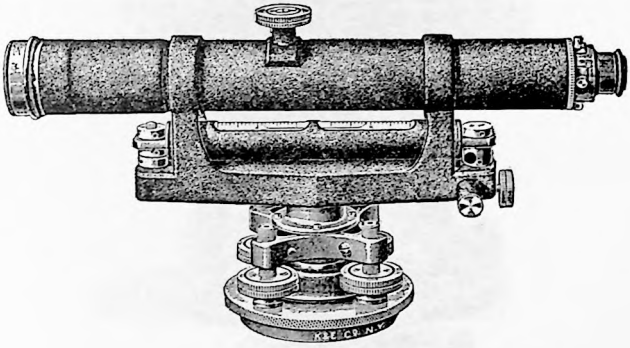
Extra Removable Axis to adapt telescope to sighting vertical lines as described on page 277. Gun metal finish.

Instrument complete, with metal trivet, plumb bob, directions, etc., in strong Box, and with No. 5176 hardwood Tripod. . . . . $

Weight of instrument about 6 lbs. Weight of tripod about $6\frac{1}{2}$ lbs.

For Extension Tripod No. 5182, see page 334.

RAILROAD DUMPY LEVEL.



No. 5118 D.

5118 D. Railroad Dumpy Level.

Telescope 12 in., achromatic astronomical (inverting), with dust cap and sunshade. OBJECT GLASS 1¾ in., with improved rack and pinion movement. EYEPIECE, with spiral adjustment for focusing cross hairs. MAGNIFYING POWER 24 diameters. SPIRIT LEVEL extra long, graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation.

Level Bar, unique design, allowing use of spirit level of unusual length, and combining great strength and stability. Improved CLAMP and TANGENT SCREW with counterspring. Telescope, tube of spirit level and level bar have Morocco finish. FOUR LEVELING SCREWS.

Center of hard bell-metal, carefully fitted. Level bar and center are cast in one piece.

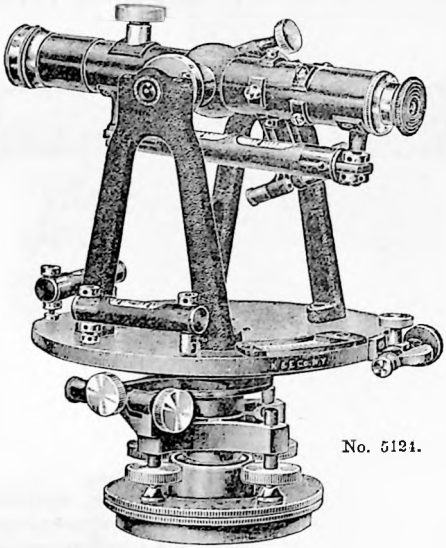
Instrument complete, with adjusting pins, waterproof cover, etc., in hardwood Box, and with No. 5175-1 Tripod. . . . . $

Weight of instrument about 7 lbs.

Weight of tripod about 8 lbs.

For other Dumpy Levels, see pages 279, 314.

BUILDER'S TRANSITS.



No. 5121.

5124. Builder's Transit.

Telescope 8 in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS 1 in., with improved rack and pinion movement. EYEPIECE with sliding adjustment, for focusing cross hairs. MAGNIFYING POWER 15 diameters. Fine SPIRIT LEVEL, graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation. CLAMP and TANGENT SCREW with counterspring.

Horizontal Limb 5 in., graduated to half degrees, with vernier reading to single minutes. CLAMP and TANGENT SCREW. Two fine SPIRIT LEVELS graduated on the glass, and ground to a sensitiveness of about 100 seconds of arc per graduation.

Centers, anti-friction, carefully fitted. FOUR LEVELING SCREWS. Shifting Center. CLAMP and TANGENT SCREW with counterspring.

Instrument complete, with plumb bob, reading glass, adjusting pins, waterproof cover, etc., in hardwood Box, and with No. 5175-1 Tripod. . . . . $

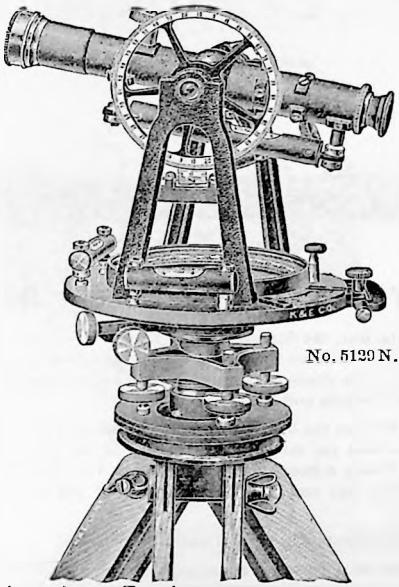
Weight of instrument about 7 lbs. Weight of tripod about 8 lbs.

***5126.** Builder's Transit as described under No. 5124, but with **full Vertical Circle** 3½ in. diameter, graduated to degrees reading by VERNIER to five minutes. Instrument complete, with No. 5175-1 Tripod, etc. . . . . $

Weight of instrument about 7 lbs. Weight of tripod about 8 lbs.

***Made to order only.**

PRELIMINARY SURVEY TRANSIT.



No. 5129 N.

5129 N. Preliminary Survey Transit.

Telescope 8 in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS 1 in. with improved rack and pinion movement. EYEPIECE with sliding adjustment for focusing cross hairs. MAGNIFYING POWER 15 diameters. STADIA HAIRS fixed, ratio 1:100. Fine SPIRIT LEVEL graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation. CLAMP and TANGENT SCREW with counterspring.

Horizontal Limb 5 in., graduated on *solid silver* to half degrees, with VERNIER reading to single minutes. CLAMP and TANGENT SCREW. Two fine SPIRIT LEVELS ground to a sensitiveness of about 100 seconds of arc per graduation.

Compass. NEEDLE about 3½ in. Compass graduated on silvered ring to one degree. VARIATION PLATE.

Vertical Circle 3½ in. diameter, graduated to half degrees, reading by VERNIER to 1 minute.

Centers, anti-friction, carefully fitted. FOUR LEVELING SCREWS. SHIFTING CENTER. CLAMP and TANGENT SCREW with counterspring.

Instrument complete, with accessories and Tripod No. 5179. . . $

Weight of transit about 8 lbs. Weight of tripod about 7 lbs.

Patent Extension Tripod No. 5181 in place of regular tripod, extra $

TRANSITS AND LEVELS

MADE BY

YOUNG AND SONS, INC.

During the war, the demand for our Extra Fine Engineer's Transits and Levels was so great that we found it necessary to devote our entire manufacturing facilities to this grade of instruments and to discontinue the manufacture of our Railroad Transits and Levels.

In order to meet the demand for medium-priced Surveying Instruments, we arranged to take the output of the factory of the old-established and well known firm of Young & Sons, Inc., Philadelphia, Pa. This firm was established over a century ago and was the originator of the American Engineer's type of Transit.

These instruments will be sold exclusively by us.

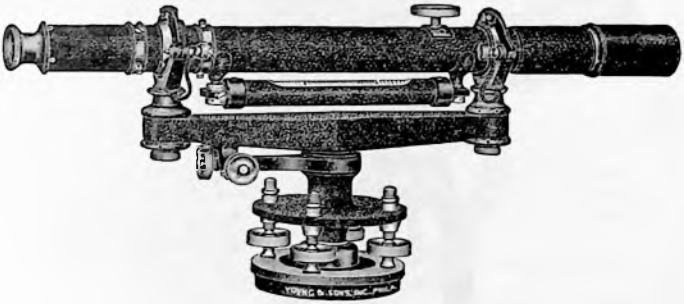
While they do not possess the many refinements and exclusive features of the K. & E. Extra fine Engineer's Transits and Levels, these instruments are of simple and substantial construction and will compare favorably in accuracy and reliability with most other makes of Surveying Instruments.

For rougher railroad work and where instruments receive and must withstand hard usage, they are particularly suitable.

There are a large number of these instruments now in use throughout the country, and the reputation that they bear is excellent.

Y. & S. ENGINEER'S Y LEVEL.

Four Leveling Screws.



5 Engineer's Y Level.

Telescope 18 in., achromatic terrestrial, with dust cap and sun-shade. OBJECT GLASS $1\frac{1}{8}$ in., focused by improved rack and pinion movement. EYEPIECE, erecting with spiral focusing arrangement. MAGNIFYING POWER about 23 diameters. SPIRIT LEVEL to telescope 6 in. long, graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation. Level tube adjustable vertically and horizontally.

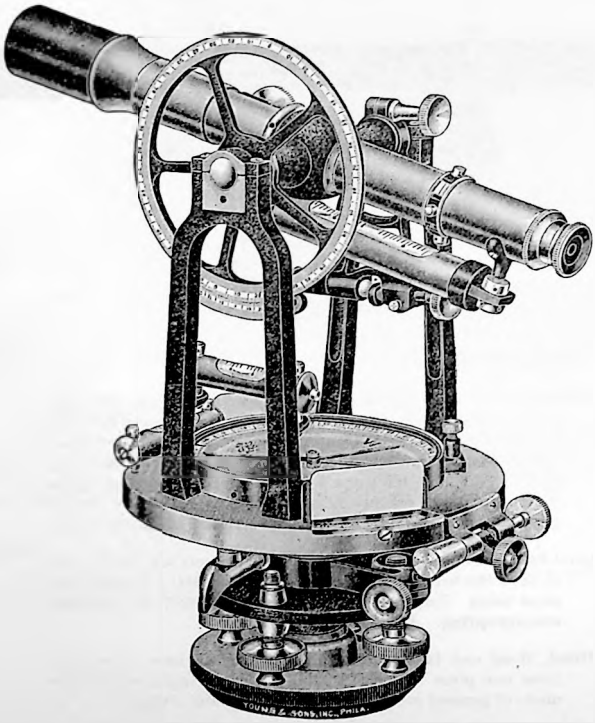
Level Bar and Center of bell metal. Telescope sets low in Y's and close to the bar. A stop insures the horizontal position of the cross hairs. Improved CLAMP and TANGENT SCREW with counter spring. Black leather finish.

Tripod, Head cast in one piece. Legs, open skeleton type made from one piece of hard wood. Shoes are *not* cast, but are made of pressed steel, forced on the legs and riveted.

Instrument complete, with adjusting pins, waterproof cover, etc., in hardwood box, with hardwood Split Tripod, ... $

Weight of Instrument about 11 lbs. Weight of Tripod about 10 lbs.

Y. & S. ENGINEER'S TRANSIT.



No. 6

Y. & S. ENGINEER'S TRANSITS.

6 Engineer's Transit.

Telescope 11¼ in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS 1⅜ in., with improved rack and pinion movement. EYEPIECE with spiral focusing arrangement. MAGNIFYING POWER about 24 diameters. STADIA HAIRS fixed, ratio 1:100. SPIRIT LEVEL to telescope, graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring. Telescope has center point for plumbing from overhead.

Horizontal Limb 6¼ in. diameter. Graduated on solid silver and numbered like Fig. IV, page 269. Opposite double-direct VERNIERS at about 45° with telescope, reading to one minute. REFLECTORS. Two SPIRIT LEVELS graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation.

Compass. NEEDLE about 4 5/16 in., edge bar form. COMPASS RING beveled, graduated to half degrees.

Vertical Circle 5 in. diameter, graduated on solid silver to half degrees. Double-direct VERNIER reading to one minute.

Centers, heavy, anti friction composition, extra long and carefully fitted. FOUR LEVELING SCREWS. SHIFTING CENTER. Improved CLAMP and TANGENT SCREW with counterspring.

Instrument complete, with plumb bob, adjusting pin, waterproof cover, etc., packed in hardwood Box and with hardwood Split Tripod . . . . . $

Weight of Instrument about 18 lbs.

Weight of Tripod about 10 lbs.

10. Engineer's Mountain Transit, as described under No. 6 but smaller model. Telescope 9 in., OBJECT GLASS 1 1/16 in.

Magnifying Power about 20 diameter.

Horizontal Limb 5 in. diameter.

Compass. Needle about 3⅜ in.

Vertical Circle 4 in. diameter.

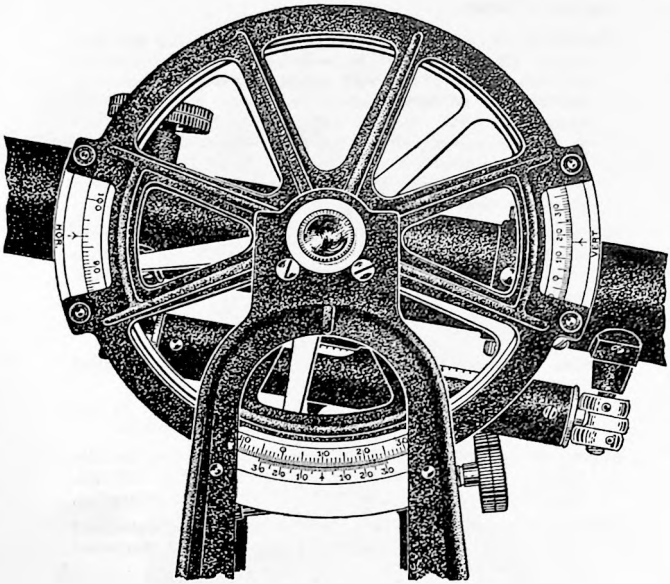
Instrument complete, with plumb bob, adjusting pin, waterproof cover, etc., packed in hardwood Box and with hardwood Split Tripod . . . . . $

Weight of Instrument about 12 lbs

Weight of Tripod about 8 lbs.

K&E STADIA CIRCLE.

Patented.



The K & E Patent Stadia Circle facilitates the computation of the true horizontal and vertical components of observed stadia distances. It is a modification of the regular transit circle whereby the degree graduations on two opposite segments of the vertical circle are replaced by special graduations, read by means of indexes attached to the guard.

The special graduations are so spaced as to give, *directly*, the percentage factors which, used as multipliers of the observed stadia distance, give the corrected horizontal and vertical components. Reading the vertical angle is unnecessary, thus eliminating reference to stadia tables, charts or the use of the Stadia Slide Rule. This greatly simplifies the taking of field notes, increases the rapidity of the work and reduces the office work to the simplest arithmetical processes.

The cut illustrates the K & E Patent Stadia Circle. The special graduations have been substituted for the regular degree graduations through a space of 60° on the right and left hand sides of the circle. This does not in any way

KEUFFEL & ESSER CO. NEW YORK

affect the usefulness of the circle and adds greatly to the compactness of the attachment. At the index to the left, marked "Hor.", is read the percentage factor to be applied to the observed stadia distance for obtaining the horizontal component. At the index to the right, marked "Vert.", is read the percentage factor to be applied to the observed stadia distance for obtaining the vertical component.

METHOD OF USING THE K & E PATENT STADIA CIRCLE.

When the K & E Patent Stadia Circle is used on Topographical work, the notes are kept as illustrated in the following example:

Sta.	Line	Bearing	Rod Interval	S Stadia Distance	H	V.	Corrected Horizontal	Corrected Vertical
A	A1	23°24' W	1.64	165.2	.96	.21	158.6	34.7

After determining the bearing, it is only necessary to read the Rod Interval, Stadia Distance (S), Horizontal Correction factor (H) and Vertical Correction factor (V).

The corrected horizontal and vertical components are computed by multiplying S by H and S by V. To avoid complicating the calculations, always bring the center cross hair of the telescope to a target or mark on the rod which has been placed at instrument height before reading H and V. If this is done, the correct difference in elevation between rod and instrument is obtained directly.

Example: Suppose the observed stadia distance to be 480 feet and the telescope, when sighted on the target, to be inclined at such an angle that the reading at the Hor. index is .97 and at the Vert. index .17. Then the correct horizontal distance would be $480 \times .97 = 465.6$ ft. and the *difference* in elevation between rod and instrument would be $480 \times .17 = 81.6$ ft. (See illustration on previous page).

5060S. Transit, equipped with the K & E Stadia Circle . . . . . $

5070S. " " . . . . .

5071S. " " . . . . .

5076S. " " . . . . .

5077S. " " . . . . .

5079S. " " . . . . .

5085S. " " . . . . .

SYNOPSIS OF TRANSITS.

All the transits have spirit level to telescope, and all have four leveling screws, except Nos. 5070, 5071, and 5081, which have three.

We furnish all our transit telescopes with erecting eyepieces except those marked †.

The Triangulation Theodolites Nos 5087 and 5087 B are omitted in this Synopsis.

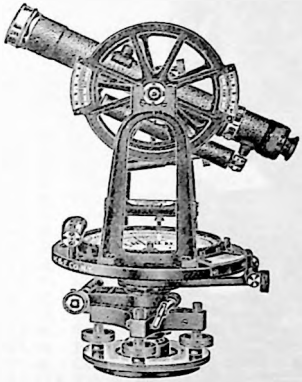
Page	No.	Telescope, inch.	Object glass, inch.	Magnification.	Comp. needle, inch.	Horiz. Limb		Vert. arc, inch.	Vert circle, inch.	Weight about, pounds
						Inch	Reads to			
289	5040	11½	1 5/16	24	4½	6¼	1 min.	. .	. .	14
291	5050	11½	1 5/16	24	4½	6¼	1 "	5	. .	14½
293	5060	11½	1 5/16	24	4½	6¼	1 "	. .	5	15
295	5070	9 †	1¼	21	4	5½	20 sec.	. .	4½	12
295	5071	9 †	1¼	21	4	5½	30 sec.	. .	4½	12
297	*5074	9	1⅛	17	4	5½	1 min.	4½	. .	11
297	5076	9	1⅛	17	4	5½	1 "	. .	4½	11½
299	5076½	9	1⅛	17	4	5½	1 "	. .	4½	13
301	5077	8	1⅛	15	3½	4⅔	1 "	. .	4	9½
303	5079	6½†	⅞	14	2¾	4	1 "	. .	3½	4½
305	5081	14 †	1½	24 & 32	. .	8	10 sec.	. .	5½	21½
307	*5082C	11½	1 5/16	24	3	6½	1 min.	. .	. .	15½
397	5084C	11½	1 5/16	24	3	6½	1 "	5	. .	15½
307	5085C	11½	1 5/16	24	3	6¼	1 "	. .	5	16
309	*5085WM	9	1½	17	. .	5½	1 "	. .	4½	12
320	5124	8	1	15	. .	5	1 "	. .	. .	7
320	*5126	8	1	15	. .	5	1 "	. .	3½	7½
321	5129N	8	1	15	3½	5	1 "	. .	3½	8

*Made to order only.

†Indicates Inverting eyepiece.

ATTACHMENTS AND SPECIAL INSTRUMENTS

FURNISHED TO ORDER.



No. 5167-41.

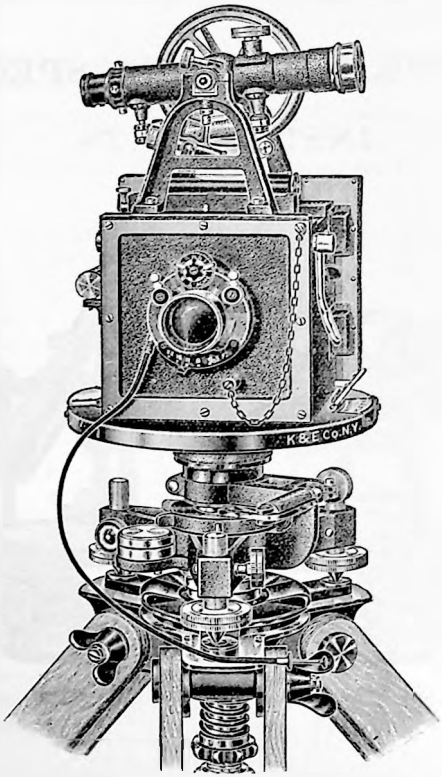
Vertical Circle with opposite Verniers and Guard, in place of regular vertical circle, . extra $



5167-42.

Vertical Circle and Vernier graduated on the periphery with Guard, in place of regular vertical circle. . . extra $

PHOTO-THEODOLITE.



The Photo-theodolite has been specially designed for the purpose of photographic surveying. Without any further auxiliary apparatus it can be used for photographic triangulating, a process technically known as Photogrametry. This method has been extensively applied in the Rocky Mountains by the U. S. and Canadian Governments.

In connection with the COMPARATOR and following the method of Stereo-Photogrametry, the use of the Photo-theodolite allows one to determine the position of hardly accessible points and to procure accurate topographic maps even in mountainous regions.

Write for booklet "Photography applied to Surveying" . . . . . $

ATTACHMENTS AND PARTS

FOR K & E TRANSITS, LEVELS AND COMPASSES.

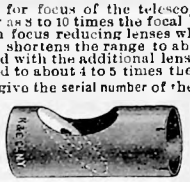
FOCUS REDUCING LENSES.

5166-1. Focus Reducing Lens for sighting near objects . . . . . each $

5166-2. do. do. do. do. set of two lenses . . . . . set

The range of adjustment for focus of the telescopes of our transits and levels permits sighting objects as near as 8 to 10 times the focal length of the object glass. To sight nearer objects we furnish focus reducing lenses which are slipped over the object glass like a cap. Lens No. 5166-1 shortens the range to about 6 to 7 times the focal length of the objective and when used with the additional lens (the combination constituting No. 5166-2) the range is shortened to about 4 to 5 times the focal length of the objective.

In ordering these lenses, give the serial number of the instrument.



No. 5167-1.

5167- 1. Improved Sunshade with Reflector for illuminating cross and stadia hairs . . . . . each $

The reflecting mirror is rigidly mounted on a short tube, placed within the tube forming the sunshade, and held in position by a stop. To use the sunshade without the reflector, the mirror with its separate tube is taken out and the sunshade turned to bring the opening in its side away from the sun.

5167- 2. Sunshade, plain . . . . . each $
5167- 3. Object glass. . . . . .
5167- 4. Colored Glass, dark with Cap to eyepiece . . . . . .
5167- 5. do. do. light, " " (ray filter) . . . . . .
5167- 6. Cap for object glass . . . . . .
5167- 7. do. " eyepiece . . . . . .
5167- 8. Clamp Screw for horizontal limb, center or telescope . . . . . .
5167- 9. Tangent Screw for " " " " " . . . . . .
5167-10. Leveling Screws . . . . . .
5167-11. Compass Needle and Center Pin . . . . . .
5167-12. Cover Glass for compass, with ground edge . . . . . .
5167-13. Cover Glass for vernier, with ground edge . . . . . .
5167-14. Steel adjusting Pins . . . . . .
5167-15. Phosphor-bronze adjusting Pins (non-magnetic, for variation plate)
5167-16. Combination Screwdriver and Center Key . . . . . .
5167-17A. Tripod Head with Bolts but without cap for 5178N, 5179, 5180 and 5181 . . . .
5167-17B do. do. do. do. do. for 5182, 5183 . . . . .
5167-17 " " " " " " 5175 . . . . . .
5167-17D " " " " " " 5175-1 . . . . . .
5167-18 " " " " " " 5176 . . . . . .
5167-19A. Leg for tripod No. 5175 . . . . . .
5167-19B. do. " " No. 5175-1 . . . . . .
5167-20. do. " " No. 5176 . . . . . .
5167-21N. do. " " Nos. 5177A, 5177B, 5178N. . . . . .
5167-22N. do. " " No. 5179 . . . . . .
5167-23. do. " " No. 5180 . . . . . .
5167-24A. do. " " No. 5181 . . . . . .
5167-24B. do. " " No. 5182, 5183. . . . . .

When ordering Attachments and Parts, please give the serial number of the instrument.
Also see list of Repair Parts for Transits and Levels, on page 330, etc.
For Spirit Levels, see page 329.

ATTACHMENTS AND PARTS.

5167-25. Waterproof Cover for transit or level . . . . . $
5167-26. Leather Case with shoulder strap for transit or level . . . . . .
5167-27. do. do. " " " for architect's level . . . . . .
or surveyor's compass . . . . . .
5167-28. Fine Oil for surveying instruments . . . . . per bottle
5167-29. Pocket Oil Cans . . . . . each
5167-30. Plumb bob chain with hook and screw eye . . . . . each

CROSS AND STADIA HAIRS.

supplied separately from instrument.

5167-31. Plain Cross Hairs and Diaphragm. . . . . .
5167-32. Replacing Cross Hairs on Diaphragm. . . . . .
5167-33. Fixed Stadia and Cross Hairs and Diaphragm. . . . . .
5167-34. Replacing Stadia and Cross Hairs on Diaphragm . . . . .

When instrument is sent to our Factory, there is an additional charge of $ for inserting and adjusting cross or stadia hairs.

The following approximate prices represent the increase in cost of an instrument when it is made to order with the attachments or modifications here listed. Applying these extras to a finished instrument, if they can be applied at all, may involve more work and consequent additional expense.

5167-40. Guard to vertical circle . . . . . extra $
5167-41. Vertical Circle with opposite Verniers and Guard, in place of regular vertical circle (see page 325) . . . . . "
5167-42. Vertical Circle and Vernier graduated on the periphery, with Guard, in place of regular vertical circle (see page 325) . . . . . "
5167-42 D. Vertical Circle and Opposite Verniers graduated on the periphery, with guard, in place of regular vertical Circle. . . . . "
5167-43. Vertical Circle with fully encasing Metal Covering, with glass covered Vernier and ground glass Reflector, in place of regular vertical circle . . . . . "
5167-46. Prism and Colored Glass with Cap to eyepiece of transit . . "
5167-49. Fixed Stadia Hairs and Diaphragm, if not regularly furnished with new instrument. . . . . "
5167-53. Disappearing Stadia Hairs and Diaphragm . . . . . "
5167-57. Improved Tangent screw with Gradienter in place of plain tangent screw . . . . . extra $
5167-62. Mounted Microscopes to verniers . . . . . each $
5167-70. Graduating horizontal limb to read to 80 seconds . . . .
5167-71. " " " " " " 20 " . . . .
5167-72. " " " " " " 10 " . . . .
5167-73. Graduating vertical circle " " " 30 " . . . .
5167-74. " " " " " " 20 " . . . .
5167-75. " " " " " " 10 " . . . .

Graduations to read to 10 or 20 seconds should be applied only to the Extra-fine Transits.

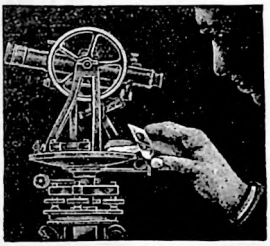


5168. Aladdin Pocket Reading Lens, with electric lamp, fine reading glass mounted in nickelplated hinged reflector, with Tungsten 3-cell battery; in nickelplated Case fitted in neat leather Pouch . . each $

5168 B. Renewal Battery (American Ever Ready Co., No. 751) in pasteboard box, for No. 5168 . . . . . "

The Battery being of Standard type and make can be obtained without difficulty at any store carrying such supplies.

The Aladdin Reading Lens is intended for the use of engineers or surveyors working in dark or badly lighted places, like mines, tunnels, forests, or at night, (polar observations, etc.). It combines a small powerful electric lamp with a reflector and a reading glass, all so constructed that the fine readings of verniers of surveying instruments, graduations of tapes, etc., can be very conveniently and accurately observed in dark places. Its light is at the same time free from the danger of igniting gases, which makes it extra valuable in coal mines, etc.



SURVEYOR'S UMBRELLA.



No. 5169.

5169. Surveyor's Umbrella. . . . . each $

A substantially built umbrella about 5 feet in diameter with 6-ft. slip jointed staff. The staff is provided with one straight and one oblique socket for holding the umbrella in the required position. It is also provided with pointed wrought iron shoe. Metal rings to umbrella ribs, for attaching brace cords.

FINE SPIRIT LEVELS.

VERY SENSITIVE, GRADUATED ON THE GLASS.

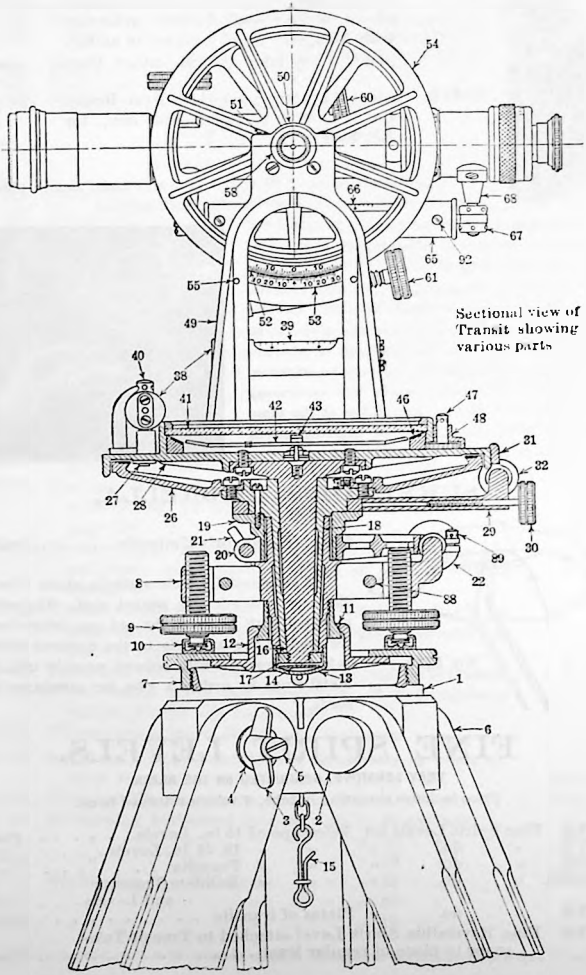
Price includes mounting in tube, if tube is returned to us.

5173 A. Fine Spirit Levels for Telescope of 15 in. Levels . . . . . each $
5173 B. " do. " " " 18, 21 in. Levels . . . . "
5173 C. " do. " " " Transits . . . . . "
5173 D.N. " do. " " " Builders Transits and Levels . . . "
5173 E. " do. " Plates of transits . . . . . "
5173 F. Fine Reversible Spirit Level attached to Transit Telescope in place of regular level . . . . . extra $

Price of Chambered Spirit Levels (for regulating the size of the bubble) quoted on application.

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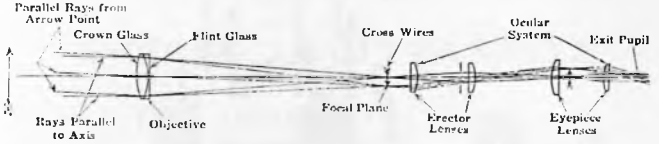
COMPONENT PARTS OF SURVEYING INSTRUMENTS.



Sectional view of Transit showing various parts

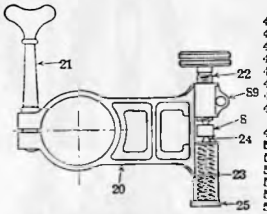
KEUFFEL & ESSER CO., NEW YORK

COMPONENT PARTS OF SURVEYING INSTRUMENTS.



Optical System

1 Tripod head
2 " bolt
3 " " nut
4 " " washer
5 " " lock screw
6 " leg
7 " plate
8 Leveling head
9 " screw
10 " " shoe
11 Half ball
12 Shifting plate
13 Center cap
14 " spring
15 Plumb bob chain & hook
16 Inner center
17 Center nut
18 Outer center
19 Clamp collar
20 Lower clamp
21 " screw
22 " " tangent screw
23 " " spring
24 " " plunger
25 " " cap
26 Horizontal limb
27 Vernier
28 " plate
29 " " clamp



30 Vernier plate clamp screw
31 " " " spring box
32 " " " tang't screw
33* " " " plunger
34* Vernier plate clamp spr'g
35* " " " cap
36* Vernier cover glass
37 " " frame
37-1* " reflector
37-2* " " hinges
38 " plate level
39 " " vial
40 " " " adjusting screw

41 Compass cover glass
42 " needle
43 " " cap
44* " " lifter
45* " " screw
46 " ring
47 " variat'n pini'n
48 " " " housing
49 A-standard
50 " cap
51 " screw
52 Vertical circle
53 " " vernier
54 " " guard
55 Vernier adjusting screw
57* Telescope axis
58 " " end cap
59* " clamp
60 " " screw
61 " " tangent screw
62* " " spring
63* " " plunger
64* " " cap
65 " level
66 " " vial
67 " " adjusting nut
68 " " support

*Not shown



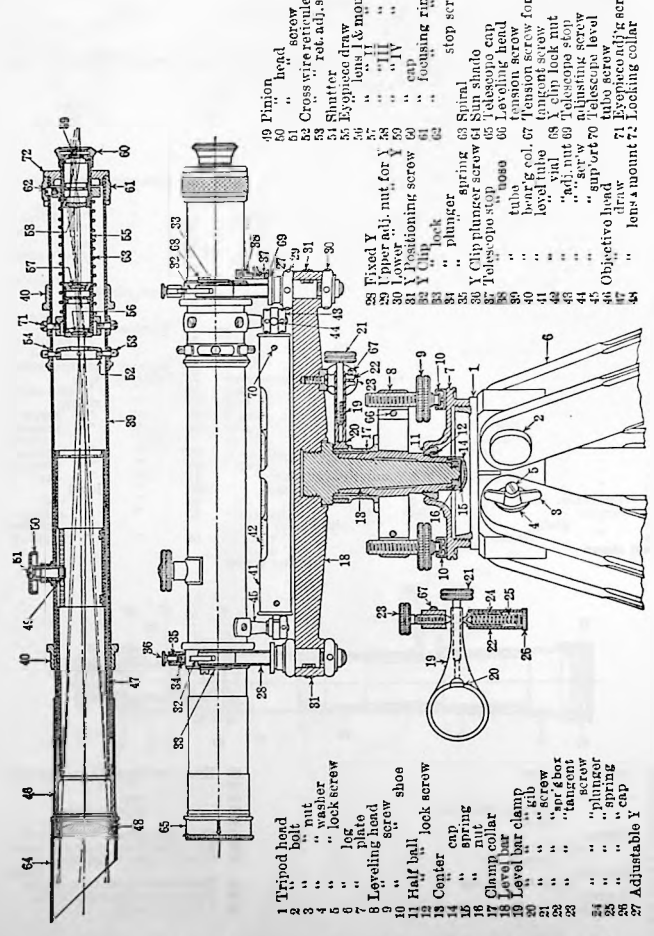
56 Telescope tube
69 " cap
70 Objective head
71 " lens and mount
72 " draw
73 Pinion
74 " head
75 " screw
76 Reticule
77 " adjusting screw
78 Shutter
79 Eyepiece lens I and mount
80 " " II "
81 " draw

82 Eyepiece lens III and mount
83 " " IV "
84 " cap
85 " focusing ring
86 " " screw
87 Shoe for spiral (not shown)
88 Leveling head tension screw
89 Tension screw for tangent screw
92 Telescope level tube screw
93 Eyepiece adjusting screw
94 Locking collar

Consult this list when ordering single parts for transits; kindly indicate serial number of instrument.

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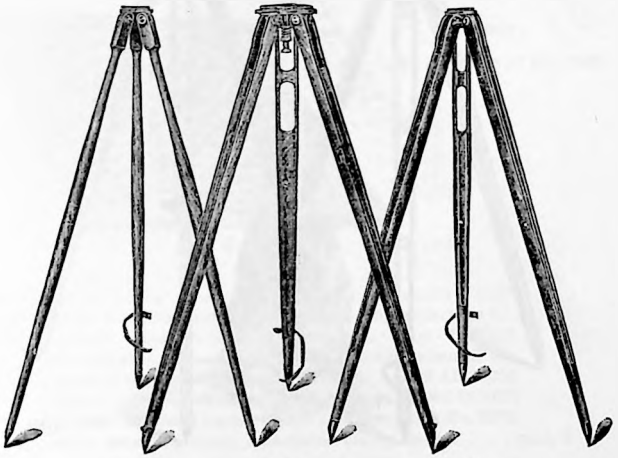
COMPONENT PARTS OF SURVEYING INSTRUMENTS.



1 Tripod head
2 " bolt
3 " " nut
4 " " washer
5 " " lock screw
6 " leg
7 " plate
8 Leveling head
9 " screw shoe
10 " "
11 Half ball
12 " " lock screw
13 Center cap
14 " spring
15 " nut
16 Clamp collar
17 Level bar clamp
18 " " "
19 " " screw
20 " " "
21 " " "
22 " " "
23 " " "
24 " " "plummet
25 " " screw
26 " " "spring
27 " " cap
27 Adjustable Y
28 Fixed Y
29 Upper adj. nut for Y
30 Lower " "
31 Y Positioning screw
32 Y Clip
33 " lock
34 " plunger
35 " spring
36 Y Clip plummet screw
37 Telescope stop
38 " tube
39 " bearg. col.
40 " level tube
41 " " vial
42 " " "
43 " " "
44 " " screw
45 " " "
46 Objective head
47 " draw
48 " lens & mount
49 Pinion
50 " head
51 " screw
52 Cross wire reticule
53 " " rot. adj. scr.
54 Shutter
55 Eyepiece draw
56 " lens I & mount
57 " " II " "
58 " " III " "
59 " " IV " "
60 " cap
61 " focusing ring
62 " "
63 Spiral
64 Sun shade
65 Telescope cap
66 Leveling head
67 " tension screw
68 Tension screw for tangent screw
69 Y clip lock nut
70 Telescope stop
71 Adjusting screw
72 Telescope level tube screw
72 Eyepiece adjg. screw
72 Locking collar

Consult this list when ordering parts for levels; kindly indicate serial number of instrument.

TRIPODS
FOR
LEVELS AND TRANSITS.



5175. 5177A. 5178N.

5175. Hardwood Tripod for levels and transits. Weight about 10 lbs. . . . . each $

5175-1. Hardwood Tripod similar to No. 5175, for Builder's Transits. Weight about 8 lbs. . . . . "

5176. Hardwood Tripod, similar to No. 5175, for Architect's Levels. Weight about 6½ lbs. . . . . "

5177A. Split Tripod of hardwood, for Three-Leveling-Screws levels. Weight about 13½ lbs. . . . . "

5177B. Split Tripod of hardwood, for Three-Leveling-Screws transits. Weight about 14 lbs. . . . . "

5178N. Split Tripod of hardwood, for levels and transits. Weight about 10 to 12 lbs. . . . . "

5179. Split Tripod for Transits No. 5077 etc., like No. 5178 N but lighter. Weight about 8 to 9 lbs. . . . . "

Split Tripods No. 5177A to 5179 are furnished with Spurs, as illustrated.

For Patent Extension Tripods, see next page.

K & E PATENT EXTENSION TRIPODS.



No. 5180.

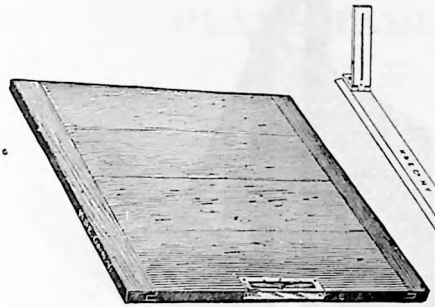
This Patent Extension Tripod combines rigidity with lightness; its manipulation is easy and its construction such that the sliding leg can neither wear loose nor bind, but will always move smoothly. The special clamps render it as steady as any solid-leg tripod, even when the legs are fully extended. The head is very firm. It is adjustable to any height between 30 and 57 inches.

5180.	Patent Extension Tripod, for levels and transits. Weight about 11 lbs. . . . . each	$
	if with instrument in place of 5178N, extra	"
5181	Patent Extension Tripod, like No. 5180, but lighter, for Builder's Transits and for Transit No. 5077. Weight about 7 lbs.	"
	if with instrument in place of 5179, extra	"
	if with instrument in place of 5175-1	"
5182.	Patent Extension Tripod, like No. 5180, but lighter, for Architect's Levels. Weight about 4½ lbs.	"
	if with instrument in place of 5176, extra	"
5193.	Patent Extension Tripod, for Transit No. 5079, like No. 5182, but very light. Weight about 4 lbs.	"
	For Tripods with one extension leg and two split legs, deduct from price of extension tripod	"

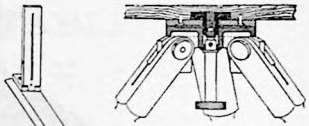
Tripods with one extension leg offer nearly all the advantages of a tripod with three extension legs, when used on uneven ground, but they cannot be put up as compactly for carrying.

For other Tripods, see preceding page.
For Repair Parts for tripods, see page 327.

TRAVERSE TABLES.



No. 5200



Tripod head of No. 5200.

5202

5200. Traverse Table, simple construction, best quality, pine-wood DRAWING BOARD, 15×15 in., with socket for improved metal swiveling attachment. Fine TROUGH COMPASS set flush with board, NEEDLE about 3 in., jeweled center, with stop. Graduated* BRASS ALIDADE 10¼ in., beveled edge (No. 5202), with FOLDING SIGHTS (alidade in sewed leather sheath). Tripod like No. 5176, stout swiveling discs, detachable clamp screw . . . . each $

5201. Traverse Table, like No. 5200, but with Patent Extension Tripod similar to No. 5182, page 334 . . . . . "

5202. Alidade for traverse table, brass, 10¼ in., graduated,* with FOLDING SIGHTS, in sewed leather Sheath . . . "

*Unless another graduation is ordered, we graduate these alidades 40 parts to the inch.



No. N5204.

N5204. Compass for Plane Table (trough compass), improved NEEDLE about 3 in., graduations on raised limb to degrees, covering 10 degrees each way . . . . . each $

For other plane table compasses, see pages 337, 339.

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PLANE TABLE

No. 5205.

Leveling arrangement of No. 5205.

Weight: Alidade about 6 lbs.
" in case 18 lbs.
Board 11 lbs.
" in case 28½ lbs.
Tripod 24½ lbs.

K & E
PLANE TABLE.

5205. K & E Plane Table

Alidade: TELESCOPE 11½ in., achromatic terrestrial with dust cap and sunshade. OBJECT GLASS 1½ in., with improved rack and pinion movement. EYEPIECE with spiral focusing arrangement. MAGNIFYING POWER 23 diameters. STADIA HAIRS fixed, ratio 1.100. Fine SPIRIT LEVEL to telescope graduated on the glass and ground to a sensitiveness of about 45 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring. Opposite VERTICAL ARCS, 4 in. diameter, graduated 30° each way to half degrees, with hinged vernier reading to one minute. Arc and vernier graduated on periphery. Brass ALIDADE BLADE 20 × 3 in., beveled fiducial edge.

Compass, brass, 5×5 in. Compass graduated on raised ring to one degree. NEEDLE about 3 in., with stop Two fine SPIRIT LEVELS graduated on the glass.

Drawing Board, white pine, thoroughly seasoned, 24×30 in., of substantial construction to prevent warping.

Leveling Arrangement, 3 screws, improved pattern, combining lightness, strength and ease of manipulation. The part supporting the board revolves in a metal socket on a large bearing surface, is provided with improved Clamp and Tangent Screw with counterspring, and holds board perfectly rigid in all positions.

Tripod, hardwood, split, very substantial and rigid.

Instrument complete with plumbing arm, plumb bob, spring clips for holding paper, in strong hardwood box, with separate wooden box for board, firm hardwood Split Tripod, etc . . $

5205A. Alidade only, as described above . . . . . $

5205J. Plane Table as described under No. 5205, but with leveling arrangement No. 5210 (after Johnson), in place of above leveling arrangement . . . . . $

KEUFFEL & ESSER CO. NEW YORK

PLANE TABLE.

Weight: Alidade about 10 lbs.
Alidade in case 21 lbs.
Board 11 lbs.
Board in case 28½ lbs.
Tripod 24½ lbs.

No. 5207.

PLANE TABLE.

5207. Plane Table.

Alidade, TELESCOPE 15½ in., achromatic astronomical (inverting), with dust cap and sunshade. OBJECT GLASS 1¼ in. with improved rack and pinion movement. EYEPIECE with spiral focusing arrangement. MAGNIFYING POWER 35 diameters. STADIA HAIRS fixed, ratio 1:100. To facilitate adjustment of cross hairs, telescope can be revolved on longitudinal axis. Fine SPIRIT LEVEL to telescope graduated on the glass and ground to a sensitiveness of about 30 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with counterspring. VERTICAL ARC 5 in. diameter, graduated on *solid silver* 30° each way to half degrees, with vernier reading to one minute. Brass ALIDADE BLADE, 3½ × 22 in., beveled fiducial edge, two fine SPIRIT LEVELS graduated on the glass. DIAGONAL SCALE on blade.

Compass. Trough pattern, covering 20°, graduated on raised arc to half degrees. NEEDLE about 5 in., with stop. Base about 1¾×7¼ in.

Drawing Board, white pine, thoroughly seasoned 24 × 30 in., of substantial construction to prevent warping.

Leveling Arrangement, 3 screws, improved pattern, combining lightness, strength and ease of manipulation. The part supporting the board revolves in a metal socket on a large bearing surface, is provided with improved Clamp and Tangent Screw with counterspring, and holds board perfectly rigid in all positions.

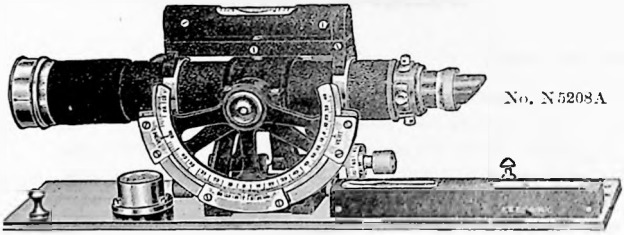
Tripod, hardwood, split, very substantial and rigid.

Instrument complete with plumbing arm, plumb bob, spring clips for holding paper, in strong hardwood box, with separate wooden box for board, firm hardwood Split Tripod, etc. . . $

5207A. Alidade only, as described above . . . . . .

5207J. Plane Table as described under No. 5207, but with Leveling Arrangement No. 5210 (after Johnson, see page 341) in place of above Leveling Arrangement . . . . . .

EXPEDITION PLANE TABLE.



No. N5208A

N5208. Plane Table.

Alidade: TELESCOPE 7½ in., achromatic terrestrial, with dust cap and sunshade. OBJECT GLASS 1⅞ in., with improved rack and pinion movement. EYEPIECE, prismatic, with spiral focusing arrangement. Eyepiece designed to give a maximum field. MAGNIFYING POWER about 16 diameters. STADIA HAIRS fixed, ratio 1:100. To facilitate adjustment of cross hairs, *telescope can be revolved on longitudinal axis.* STRIDING SPIRIT LEVEL to telescope graduated on the glass and ground to a sensitiveness of about 60 seconds of arc per graduation. Improved CLAMP and TANGENT SCREW with gradienter and counterspring. VERTICAL ARC, 4 in. diameter graduated to half degrees with double-direct vernier reading to one minute. Reads angles of elevation to 30 degrees, and of depression to 18 degrees. TANGENT SCREW for zero setting. K & E PATENT STADIA ARC. Brass ALIDADE BLADE 11 × 2¾ in., beveled fiducial edge, graduated 50 parts to the inch; circular spirit level with hermetically sealed vial. COMPASS, Trough pattern. NEEDLE about 4 in. with stop. North end of trough engraved "N".

Above packed in solid leather, velvet-lined box with shoulder straps. Box 3½ × 4 × 11½ in.

Weight of alidade about 3½ lbs. Height of alidade 3½ in.

Drawing Board, white pine, thoroughly seasoned, 18×24 in., of substantial construction to prevent warping.

Tripod, extension type, with Johnson Leveling attachment, hardwood, very substantial and rigid.

Instrument complete with board and extension Tripod, etc. . . . $

N5208A. Alidade only, as described above . . . . . each $

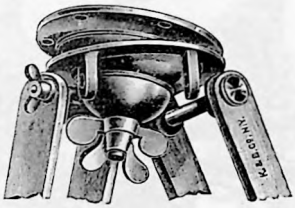
N5209. Plane-Table described under No. N5208, but alidade with fixed telescope, (does not revolve on longitudinal axis,) plain arc (without K & E PATENT STADIA ARC) and without the gradienter screw, but with clamp and tangent screw . . each $

N5209A. Alidade, only as described under No. N 5209 . . . . . each $

Each of the above alidades can successfully be used with Traverse Tables No. 5200 or 5201.

PLANE TABLE LEVELING ARRANGEMENT

(after Johnson)

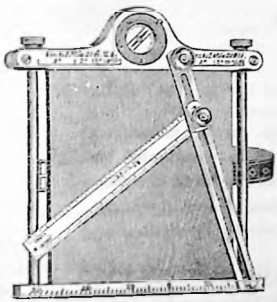


No. 5210.

(The cut shows one leg of the tripod removed, to afford a better view of the construction).

5210. Leveling arrangement (after Johnson) very simple and efficient, consists of two sphere segments movable within one another and two wing nuts, one to keep the segments in apposition, the other to clamp them. With stout split hardwood Tripod, weighing about 11 lbs. . . . . $

This leveling arrangement is furnished with Plane Tables Nos. 5205 J and 5207 J.



CAVALRY SKETCHING CASE.

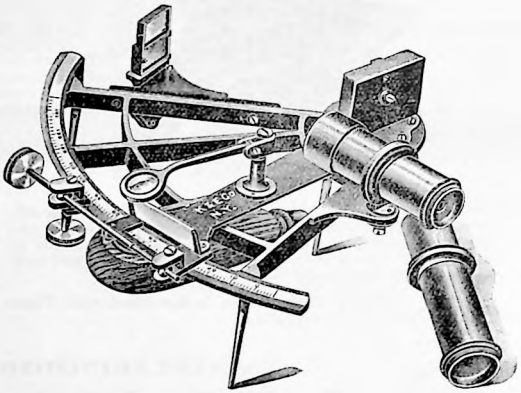
5212. Cavalry Sketching Case, as made by us for the U. S. Army. Board surface 6½x7½ in., rollers for paper with set screws, brass arm and scale, compass with scores, swiveling Handle Strap . . . . . each $

The compass is set flush, numbered at every 5° up to 180°, compass cover with notches, stop to needle. Brass Scale Arm and Scale connected by sliding block with clamp screw. Scale 7 in., graduated 8 inches to the mile and inches in 10ths. Clinometer Scale graduated to one degree. Scales of Vertical Intervals on upper cross piece, 2, 3, 4, 5 inches to the mile. Two wooden tubes, with retaining springs for 4 pencils, on back of board.

5212 P. Sketching Paper for No. 5212, in rolls of 6½ yards 7 in. wide. . . . . per roll

5214. Engineer's Sketching Board, as made by us for the U. S. Army. Board 12⅛ × 15 in., white pine, reinforce strips on end to prevent warping and splitting. Trough Compass 8 in. needle, set in flush with one edge. Four clamp screws for holding paper. Stamped on board: inch scale, plotting slope scales and tangent scale. Boxwood alidade, triangular, 8½ in., with plotting slope scales, inch scale: 1, 3 and 6 inches to the mile, in hundreds of yards. Threaded brass plate on reverse side of board to receive tripod bolt.
Fits on standard camera Tripod.

SEXTANTS.



No. 5223 B.

5223. Sextant for Land Surveying, gun metal, measuring angles up to 130 degrees. Radius 6 in., graduated on *solid silver* to 20 minutes, vernier reading to 30 seconds, Clamp and Tangent Screw to vernier. Mounted reading lens. Plain sighting tube.

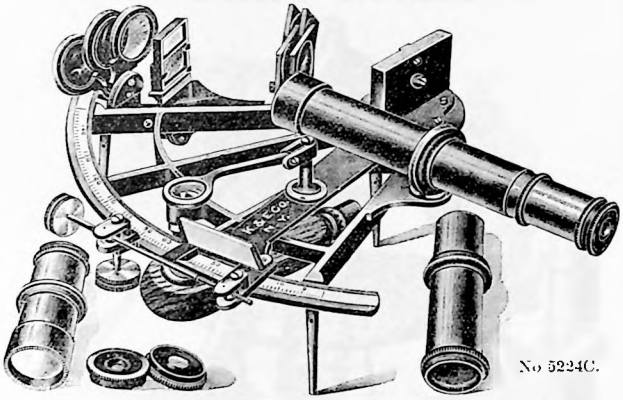
Instrument complete, with adjusting key and screw driver, in polished mahogany Case with Lock. . . . . each $

5223 B. Sextant for Land Surveying, like No. 5223, with plain sighting tube and star telescope.

Instrument complete, with adjusting key and screw driver, in polished mahogany Case with Lock . . . . . ::

We have special apparatus for testing sextants of any make for eccentricity and errors of graduation, and as large manufacturers of sextants, have the best facilities for repairing these instruments.

SEXTANTS.



No 5224C.

5224. Sextant, Mariner's, gun metal, measuring angles up to 130 degrees. Radius 6 in., graduated on *solid silver* to 20 minutes, vernier reading to 30 seconds, Clamp and Tangent Screw to vernier. Mounted reading lens. 1 plain sighting tube, 1 inverting telescope (power about 6 diam.), 2 neutral glasses for telescope, 7 neutral glasses to sextant.

Instrument complete, with adjusting key and screw driver, in polished mahogany Case with Lock . . . . . each $

5224 B. Sextant, Mariner's, as described under No. 5224, but with adjustable telescope holder. Instrument complete, as above "

5224 C. Sextant, Mariner's, gun metal, measuring angles up to 130 degrees. Radius 6 in., graduated on *solid silver* to 20 minutes, Vernier reading to 30 seconds, Clamp and Tangent screw to vernier. Mounted reading lens. 1 plain sighting tube, 1 inverting telescope (power about 6 diam.), 1 star telescope; 2 neutral glasses for telescope, 7 neutral glasses to sextant.

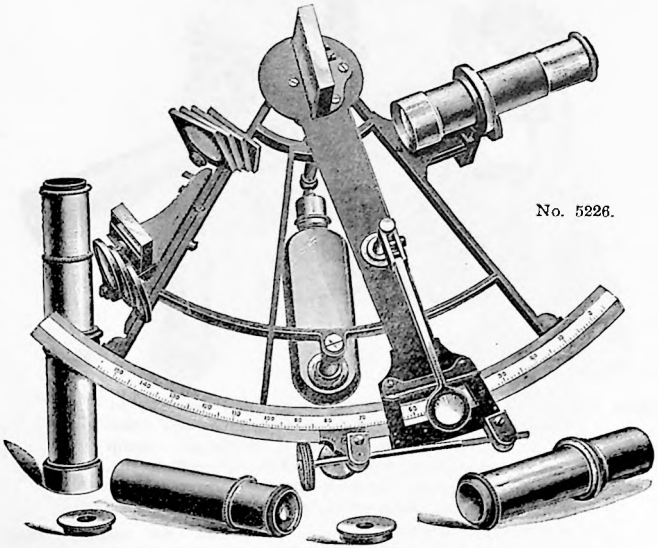
Instrument complete, with adjusting key and screw driver, in polished mahogany Case with Lock . . . . . "

5224 D. Sextant, Mariner's, as described under No. 5224C, but with adjustable telescope holder. Instrument complete, as above "

We have special apparatus for testing sextants of any make for eccentricity and errors of graduation, and as large manufacturers of sextants, have the best facilities for repairing these instruments.

For Artificial Horizons, see page 345.

SEXTANTS.



No. 5226.

5226. Sextant, high-grade, gun metal, measuring angles up to 145 degrees. Radius 6 in. Graduated on *solid silver* to 10 minutes, vernier reading to 10 seconds; mounted reading lens, Clamp and Tangent Screw to vernier. 1 sighting tube, 1 star telescope, 1 inverting telescope with two eyepieces, magnifying powers 6 and 12 diam.; 7 neutral glasses to sextant, 2 neutral glasses for telescopes, adjustable telescope holder.

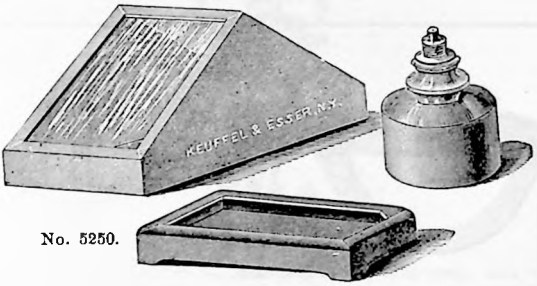
Instrument complete, with adjusting key and two screw-drivers, in fine polished mahogany Case with Lock . . each $

5227. Sextant, Surveying, of gun metal, as made by us for the U. S. Navy; measuring angles up to 145 degrees. Radius 6 in. Graduated on *solid silver* to 20 minutes, vernier reading to 30 seconds; mounted reading lens, Clamp and Tangent Screw to vernier. 1 sighting tube, 1 star telescope, 1 inverting telescope, magnifying power 6 diam., 7 neutral glasses to sextant, 2 neutral glasses for telescope, adjustable telescope holder.

Instrument complete, with adjusting key and two screw-drivers, in polished mahogany Case with Lock . . . . "

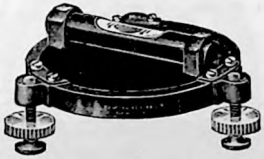
We have special apparatus, for testing sextants of any make for eccentricity and errors of graduation, and as large manufacturers of sextants, have the best facilities for repairing these instruments.

ARTIFICIAL HORIZONS.



No. 5250.

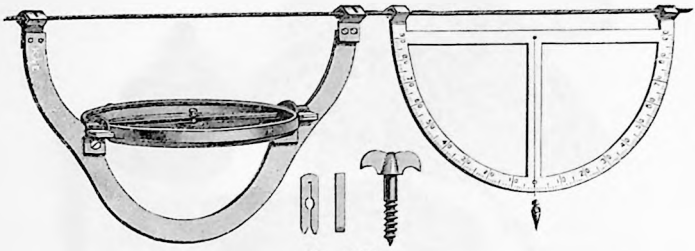
5250. Mercurial Horizon, as made by us for the U. S. Navy. Bronzed brass roof, $3\frac{1}{4} \times 7\frac{3}{8} \times 4\frac{1}{2}$ in. high, fine plane glasses $2\frac{3}{4} \times 4\frac{1}{8}$ in., iron mercury bottle with threaded stopper and funnel top. Iron mercury trough with thread for funnel, and lip. Polished mahogany Case, with carrying strap. Complete, with Mercury . . . . . each $



No. 5251.

5251. Reflecting Horizon, black glass, accurately ground plane surface $3\frac{3}{8}$ in. diameter, mounted in bronzed brass frame, with three leveling screws, fine graduated adjustable spirit level in bronzed metal mounting, polished mahogany Case . . . . . each $

MINING COMPASS AND CLINOMETER.

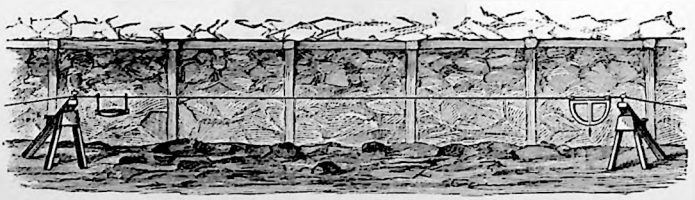


No. 5280.

5280. Mining Compass and Clinometer, Compass graduated to half degrees, suspended in a frame with hooks by a universal joint (gimbal), needle about 3 in., with stop. Clinometer, aluminum, 7 in. diameter, graduated to half degrees, with hooks and plumb bob, screws for cord, brass stop; in chamois-lined leather Sling Case . each $

5280B. Station bucks . . . . . per pair

5280C. Water-proof cord, 80 feet, on reel . . . . . .



Mining Compass and Clinometer in use.

MINING LAMP AND PLUMMET.



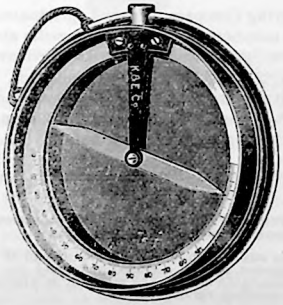
No. 5285.

5285. One Plummet, about 6½ in.; in mahogany Box with strap, each $

5286. Two Plummets; in mahogany Box with strap . . . . . pair

This is a large brass Plummet 2 in. diameter, 6½ in. long, with steel point, weight about 20 oz., mounted in gimbal with chains for suspending. The upper part is hollow, for oil, and provided with a burner, forming a lamp. The sight is taken to center of flame.

MINER'S COMPASS
OR DIPPING NEEDLE.

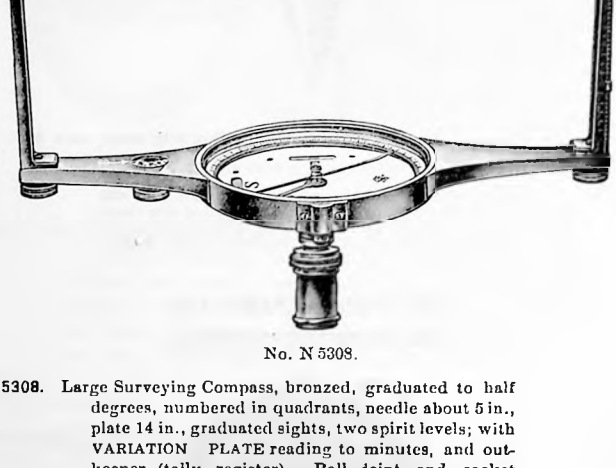


No. 5293.

5293. Miner's Compass or Dipping Needle, 3¾ in., needle about 3 in., with stop, glass and morocco-finished brass covers on both sides; with Directions . . . . . each $

SURVEYING COMPASSES.

In Surveying Compasses the East and West lettering is reversed from its position on the map. This is because the needle is the fixed point while the compass box is revolved in directing the sights to the object observed. For instance, in sighting a point situated N. W. the needle will point N. E., but it will correctly read N. W. in accordance with the line actually sighted, because the East quadrant is marked West.



No. N 5308.

N 5308. Large Surveying Compass, bronzed, graduated to half degrees, numbered in quadrants, needle about 5 in., plate 14 in., graduated sights, two spirit levels; with VARIATION PLATE reading to minutes, and out-keeper (tally register). Ball joint and socket (No. 5348-4, page 351) for Jacob staff mounting; in polished mahogany Case with handle . . . . . each $

N 5310. do. do. needle about 6 in., plate 16 in., "

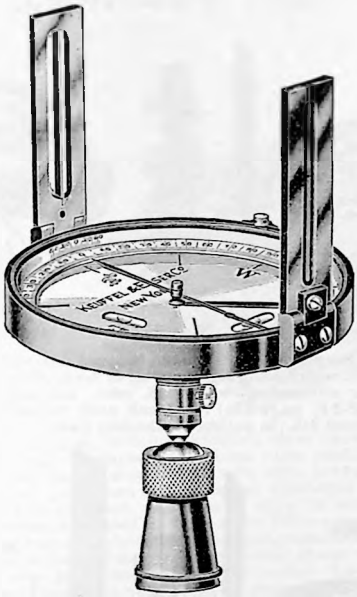
The Surveying Compasses Nos. N5308 and N5310 represent the latest type of these instruments, which we have improved in many features.

The compass box is sunk flush with the plate instead of projecting above it. The graduations, to half degrees, are on a raised ring and the needle is of our improved pattern. One of the detachable sights, the window, is graduated and provided with a sliding crosspiece for measuring vertical angles.

The variation of the needle is set off by a capstan-head pinion. The vernier of the variation arc reads to minutes. With these compasses we furnish adjusting pins of phosphor bronze, which do not disturb the needle.

Nos. N 5308 and N 5310 fit on Jacob staff No. 5350 and tripod No. 5356 A.; see page 352.

SURVEYING COMPASSES.



No. 5320.

5320. Surveying Compass, with folding sights, graduated on raised ring to degrees, VARIATION PLATE, two spirit levels, ball joint and socket (No. 5348-2, page 351) for Jacob staff mounting, needle about 3½ in.; in polished mahogany Case . . . . . each $

5321A. do. do. like No. 5320, but needle about 4 in., and with fore and back sights, ball joint and socket (No. 5348-3, page 351); in polished mahogany Case. " $

5322A. do. do. like No. 5320, but needle about 4½ in., ring graduated to half degrees, and with fore and back sights, ball joint and socket (No. 5348-3, page 351); in polished mahogany Case . . . . . " $

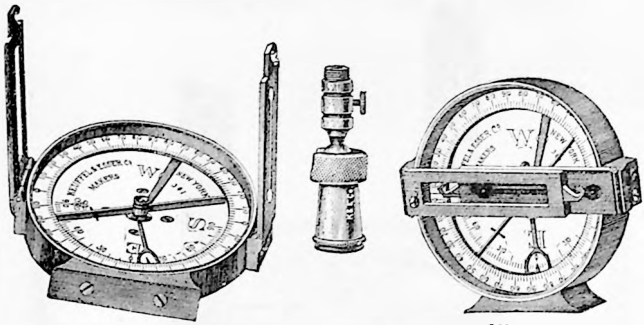
Compasses Nos. 5320 to 5322A are well constructed, and workmanship and material are of the best. The variation of the needle is set off by a capstan-head pinion. The vernier of the variation arc reads to 5 minutes. With these compasses we furnish adjusting pins of phosphor bronze which do not disturb the needle.

Sewed leather Sling Case **in place of mahogany case.**

	for Compasses	3	3½	4	4½ in.
extra . . . . . each $					

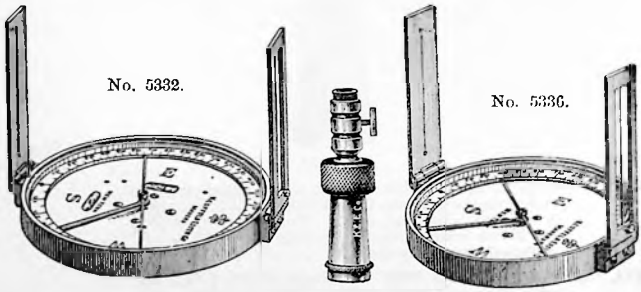
Nos. 5320 to 5322A fit on Jacob staff No. 5350 and tripods Nos. 5352 and 5360.

SURVEYING COMPASSES.



as Compass. No. 5331½. as Clinometer.

5331½. Surveying Compass and Clinometer, bronzed, graduated to degrees, with folding sights ending in hooks, fiducial edge for clinometer, with ball joint and socket (No. 5348-2F, page 351) for Jacob staff mounting, needle about 3 in.; in polished mahogany Case, ... each $



No. 5332. No. 5336.

5332. Surveying Compass, graduated on raised ring to degrees, with folding sights, 2 spirit levels, ball joint and socket (No. 5348-2, page 351) for Jacob staff mounting, needle about 3 in.; in mahogany Case, ... each $

5333. do. do. needle about 3½; in mahogany Case . . "

5334. do. do. " " 4 " ball joint and socket (No. 5348-3, page 351); in mahogany Case . . . . . "

5336. Surveying Compass, like No. 5332, but without spirit levels, needle about 8 in., ball joint and socket (No. 5348-2, page 351); in mahogany Case . . . . . "

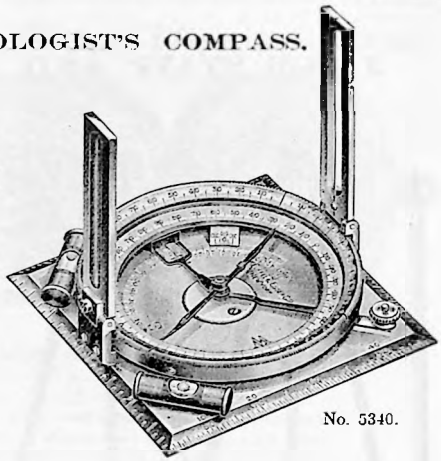
Nos. 5331½ to 5336 fit on Jacob staff No. 5350 and tripods Nos. 5352 and 5360.

For Leather Cases in place of mahogany, see page 349.

GEOLOGIST'S COMPASS.



No. 5348-5.



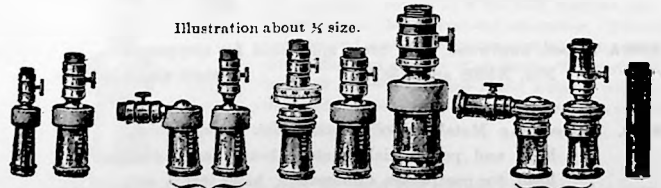
No. 5340.

5340. Geologist's Compass, aluminum, folding brass sights. Raised compass ring graduated to degrees, variation plate reading by vernier to 5 minutes. Improved needle about 2½ in. with stop, jeweled center. Beveled ring on compass box, graduated to degrees and numbered in quadrants, with sighting mark at each quadrant, and knurled edge for revolving in azimuth. Pendulum clinometer graduated to degrees for 90 degrees in each direction. Base 4 x 4 in., all four edges beveled; two edges graduated as a protractor, one edge graduated to inches and eighths, representing chains on scale of 1 inch to 1 mile, the other edge graduated to inches and tenths. Two spirit levels on the base. A diagram of township numbering on under side of base. Instrument complete with ball joint and socket No. 5348-5 for Jacob staff mounting; in sewed leather Case with shoulder strap. . . . . each $

The Geologist's Compass is used largely in topographical work. It is light and portable. The variation of the needle is set off by revolving the raised compass ring by means of a slotted screw projecting through the side of the compass box, which serves also as set screw. The beveled ring can be used for turning right angles or for sighting vertical angles by placing the edge of the base on a level surface. Compass fits on Jacob staff No. 5350 and tripods Nos. 5352 and 5360.

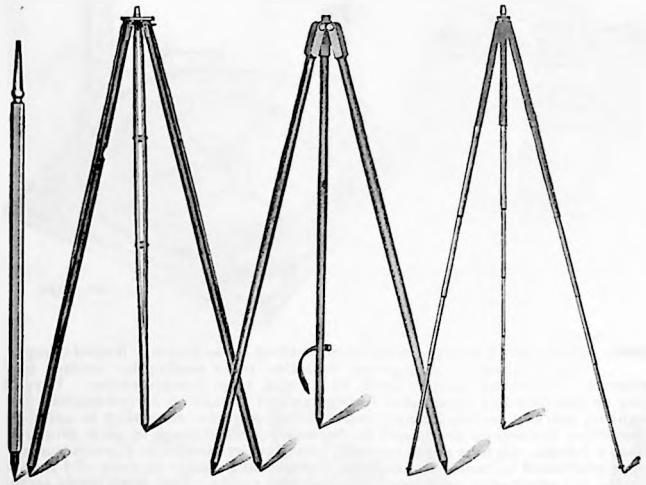
BALL JOINTS AND SOCKETS FOR JACOB STAFF MOUNTING.

Illustration about ½ size.



	1	2		2F	2G	3	4		5	6
5348.	-1		-2	-2F	-2G	-3	-4		-5	-6
each $										

JACOB STAFF AND TRIPODS



No. 5350. 5352. 5356A. 5360.

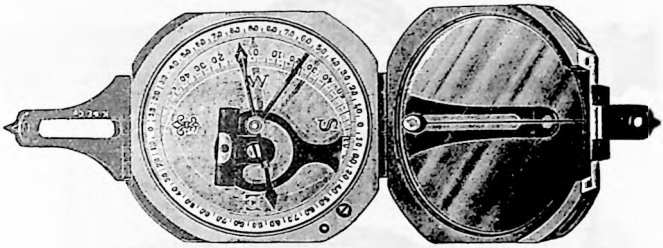
5350. Jacob Staff, 54 in., hardwood, iron shoe. Weight about 2 lbs each $

5352. Tripod, split, with brass staff head for light compasses, hand levels, etc. Weight about 4 lbs "

5356A. Tripod, hardwood, with brass staff head for compasses Nos. N5308 and N5310. Weight about 5½ lbs "

5360. Telescoping Metal Tripod, brass, black enamel finish, head and points nickelplated, brass Jacob staff head, for compasses, clinometers, hand levels, etc. Length closed 16½ in., extended 60 in. Weight about 3 lbs "

POCKET TRANSITS (after BRUNTON).



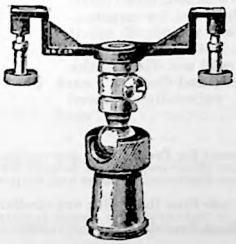
No. 5368-1.

5368-1. Pocket Transit (after Brunton), aluminum. Cover with fine mirror and center line, hinged brass peep sight and sighting point. Raised compass ring graduated to degrees, numbered in quadrants. Variation plate graduated to degrees. Variation set by pinion with slotted head. Improved needle about $2\frac{1}{8}$ in. with jeweled center and automatic stop. Clinometer arc graduated to degrees, reading by vernier on clinometer arm to 5 minutes. Sensitive spirit level to clinometer arm. Instrument Case, made of solid aluminum casting, measures $2\frac{3}{4} \times 2\frac{3}{4} \times 1$ in. and weighs about 8 oz. With Directions . . . . . each $

5368-2. Pocket Transit (after Brunton), like No. 5368-1, but compass ring numbered 0 to 360° . . . . . "

5368S. Sewed Leather Sling Case for No. 5368-1 or -2 . . . . . "

5368J. Special ball joint and socket for mounting pocket transit No. 5368-1 or -2 on tripod, ... "

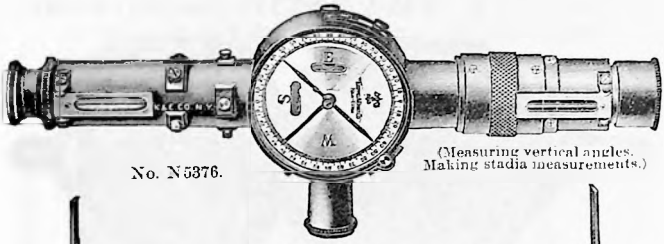


The Pocket Transit (after Brunton) combines the principal features of a sighting compass, prismatic compass, hand level and clinometer. It is an accurate and convenient instrument for topographic and preliminary surveys of all kinds. The variation is set off by revolving the raised compass ring by means of a slotted pinion projecting through a corner of the compass box.

No. 5368 J. fits Jacob staff No. 5350 and tripods Nos. 5352 and 5360.

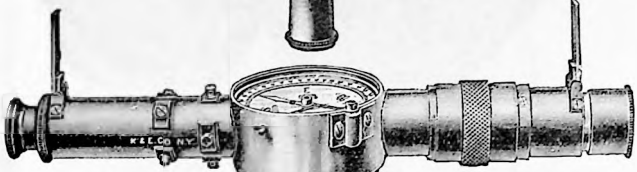
For Tripod for Pocket Transit, see No. 5360, page 352.

STADIA HAND TRANSITS.



No. N5376.

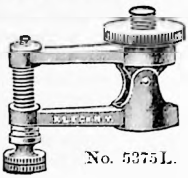
(Measuring vertical angles. Making stadia measurements.)





Appearance of field.

No. N5376.
(Taking compass bearings.)



No. 5375L.

N5376. Stadia Hand Transit, achromatic terrestrial telescope, 10 in., object glass 1 in., magnifying power about 12 diam., with cross hairs, and fixed stadia hairs ratio 1:100, folding sights. **Improved spiral focusing arrangement.** Clinometer and Altimeter formed by accurately balanced sensitive weighted ring with automatic stop, gives vertical angles to single degrees, up to 45° both ways, and slopes in feet per 100 feet horizontal, or centimeters per meter. Compass $2\frac{3}{4}$ in., graduated on silvered raised ring to single degrees, variation plate set by capstan-head pinion, improved needle with jeweled center, 2 spirit levels. Folding ball joint and socket, No. 5348-2F, page 851. Adjusting pin of phosphor bronze (which will not disturb the needle) for setting variation plate; in velvet-lined Case, . . each $

5376S. Stadia Hand Transit, like N 5376 but in velvet-lined sewed leather Case with shoulder strap. . . . . each "

5375L. Micrometer Leveling Attachment . . . . . "

The Improved Stadia Hand Transit is an ideal instrument for Preliminary Surveying, being strongly made, very compact, and weighing less than three pounds. It is used for measuring: Vertical Angles, Horizontal Angles, (Compass Surveys), Grades and Slopes (in per cent. or degrees), and Distances.

Results are obtained with far greater accuracy and in less time than with any similar portable instrument. For the Engineer, Road Builder or Surveyor who wants results quickly and with a fair degree of accuracy, the Stadia Hand Transit fills every requirement.

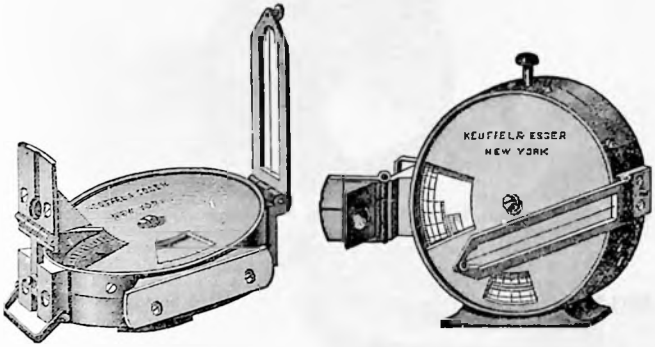
In measuring vertical angles, the sighted object and the two scale readings (slopes and degrees) appear together in the field of view (see cut). Compass bearings can be sighted by the telescope on level ground or by the folding sights on sloping ground.

The Leveling Attachment adds considerably to the accuracy of the Stadia Hand Transit, especially when sighting at long range.

For Flexible (Pocket) Leveling Rods, see page 403.
For Jacob Staff and Tripods, see page 352.

PRISMATIC COMPASSES.

Prismatic Compasses permit of observation of the magnetic azimuth of objects not in the plane of the observer. The object by means of the wire of the sight vane, is vertically projected to the plane of observation, so that angles are observed in one plane, as if laid down on a map. Accuracy can be increased by repeating the observations and taking their mean, or by backsighting.



as Compass. No. 5400. as Clinometer.

5400. Prismatic Compass, Clinometer and Altimeter, bronzed case. Compass dial 2¾ in. diameter, graduated to half degrees, jeweled center, automatic stop and spring check. Hinged sight vane with vertical wire. Gravity Clinometer and Altimeter formed by accurately balanced, sensitive, weighted disc 2¾ in. diameter, with stop and spring check, giving angles of elevation or depression in half degrees and slopes in inches per yard. The inclination is read under the hair line on the cover glass. The compass is read by the lens-front prism which is adjustable for focus. Fiducial edge for clinometer. Plain tubular handle (No. 5348-6, page 351), for mounting on staff. With Directions . . . . . each $

5400S. Prismatic Compass, like No. 5400 but in sewed leather sling Case . . . . . "

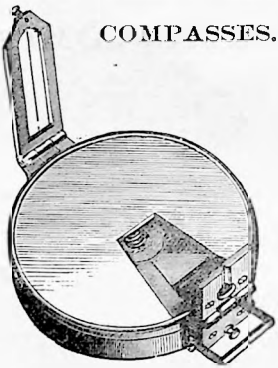
5400M. Prismatic Compass, Clinometer and Altimeter, like No. 5400, but clinometer giving slopes in centimeters per meter . . . . . "

5400MS. Prismatic Compass, No. 5400M but in sewed leather sling Case . . . . . "

For Folding Ball joint and socket No. 5348-2F in place of tubular handle No. 5348-6 . . . . . add

For Jacob Staff and Tripods, see page 352.

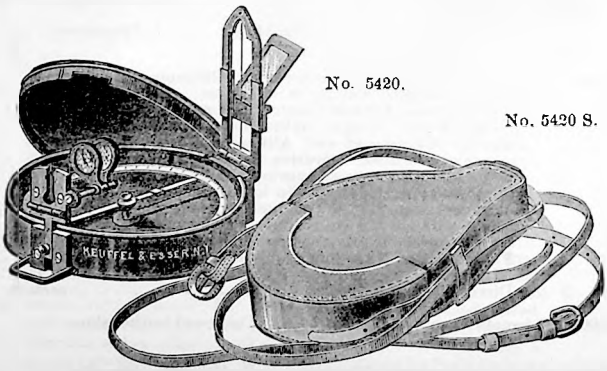
PRISMATIC COMPASSES.



No. 5411.

5411. Hutchinson's Prismatic Compass, 3 in., bronzed, of improved pattern, nearly enclosed top, floating card dial graduated to half degrees, jeweled center, automatic stop and spring check, sight vane with vertical wire; in strong leather pouch with belt loop; with Directions . . . . . each $

5411 S. Hutchinson's Prismatic Compass No. 5411, but in sewed leather sling Case . . . . . " $



No. 5420.

No. 5420 S.

5420. Prismatic Compass, 2½ in., floating aluminum ring, graduated to half degrees, jeweled center, automatic stop and spring check, hinged sight vane with vertical wire and sliding mirror, which can be reversed to face upwards, or downwards when sighting objects much above or below the horizontal plane, dark glasses for observing the sun's magnetic azimuth; with adaptor for Ball joint and socket; with Directions . . . . . each $

5420 S. Prismatic Compass, No. 5420 but in sewed leather sling Case $

Ball joint and Socket for No. 5420 (No. 5348-2, page 351.) . . . extra $

PRISMATIC COMPASSES.



No. 5430.

5430. Prismatic Compass, 2 in., liquid, with floating dial, radium luminous graduations and figures for night observations. Compass case has notches for aligning it on the Plane table or map. Instrument in strong leather sling Case with belt loop and Directions, ... each $

5435. Prismatic Compass, dry, with floating dial, similar to No. 5430, but not luminous . . . . . each $

These are very compact and accurate instruments. While mainly intended for military use, they can also be recommended to the traveler, etc.

SIGHT COMPASSES.



No. 5441.



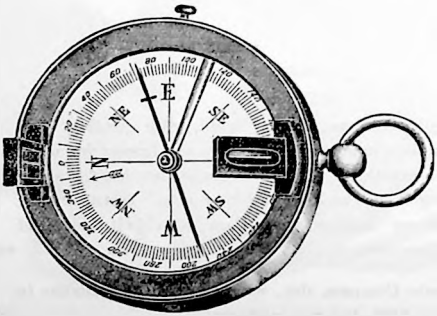
No. 5446.

5440. Bronzed Pocket Compass, 2½ in., pull-off cover, metal dial graduated to degrees, folding sights, edge bar needle with jeweled center and stop . . . . . each $

5441. do. do. do. 3 in. . . . . "

5446. Bronzed Pocket Compass, 2 in., watch pattern, folding sights, graduated to 2 degrees on raised ring, needle with jeweled center and stop . . . . . "

5447. do. do. do. 2⅜ in. . . . . "

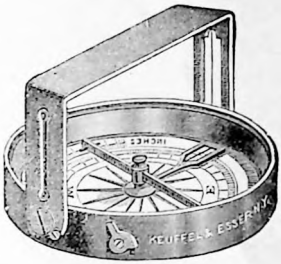


No. 5453.

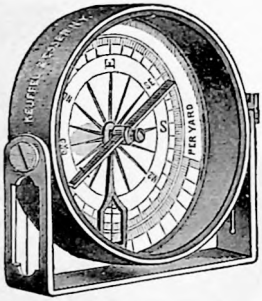
5452. Pocket Compass, 2⅜ in., brass case, pull-off cover, folding sights, metal dial graduated to 2 degrees, edge-bar needle with jeweled center and stop . . . . . each $

5453. do. do. 2¼ in. . . . . "

COMPASSES WITH CLINOMETER.



as Compass



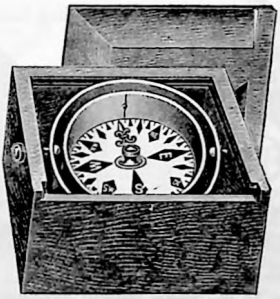
No. 5460.

as Clinometer.

5460. Bronzed Sight Compass and Clinometer, 2½ in. diameter, graduated to degrees, numbered in quadrants, bar needle with stop. The sights are connected by a bar across the top, which when turned down serves as fiducial edge for the clinometer. The clinometer is graduated to give slopes in inches per yard and in degrees. This is a very practical instrument for taking angles, bearings, slopes, altitudes, etc. Its lightness and small size add to its usefulness. In polished mahogany Case . . . . . each $

5461. do. do. do. do. 3 in. diameter "

BOAT COMPASSES.



No. 5495.

K & E Dry Compasses, flat card dial, jeweled center, brass bowl hung in gimbals; in mahogany slide-lid box.

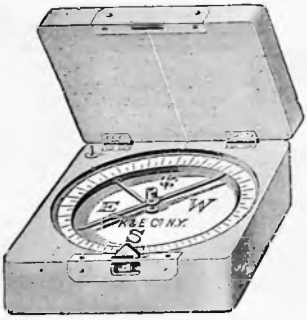
5495. Boat Compass, dial 2 in., box 3⅞ × 3⅞ in. . . . . each $

5496. " " " 3 " " 4⅞ × 4⅞ " . . . . . "

5497. " " " 4 " " 6⅛ × 6⅛ " . . . . . "

5498. " " " 5 " " 7⅛ × 7⅛ " . . . . . "

SPECIAL POCKET COMPASSES.



No. 5602.

5602. Military Compass, 3×3 in., needle 2 in., with jeweled center and automatic stop, graduated on raised metal ring to degrees, numbered 0—360; polished mahogany case with sighting line on lid . . . . . each $

5602 C. Military Compass, like No. 5602, but with Clinometer "

5602 X. Military Compass, like No. 5602, but numbered in quadrants "

5602½. Military Compass, like No. 5602, but 3¾×3¾ in., needle 2½ in., numbered 0–360 . . . . . "

5602½X. Military Compass, like No. 5602½, numbered in quadrants "

Watch Pattern, Hunting Case.



No. 5610.



5611.

5610. Pocket Compass, 1¾ in., watch pattern hunting case, nickel plated, Singer Pearl Dial, edge bar needle with jeweled center and stop . . . . . each $

5611. Pocket Compass, 2 in., watch pattern, exceptionally thin hunting case, gun metal finish, etched metal Dial, black and silvered, graduated every 5°, numbered every 20° from 0 to 360°, edge bar needle with jeweled center and stop. Radium luminous indicators for night observation "

POCKET COMPASSES.

Watch Pattern, Hunting Case.



No. 5612.



No. 5613.



No. 5615.

5612. Pocket Compass, nickel silver, watch-pattern hunting case, 1¾ in., floating dial graduated every 5°, numbered every 15° from 0 to 360°. Jeweled center and stop . . . . . each $

5613. Pocket Compass, nickel silver, watch-pattern hunting case; 1¾ in., etched metal dial silvered and graduated every 5°, numbered every 15° from 0 to 360°. Edge-bar needle, weighted at north end, with jeweled center and stop . . each $

5615. Pocket Compass, like No. 5613, but flat needle, with jeweled center and stop . . . . . each $



No. 5612 R.



No. 5613 R.

5612 R. Pocket Compass, like No. 5612, but with radium luminous indicators for night observation . . . . . each $

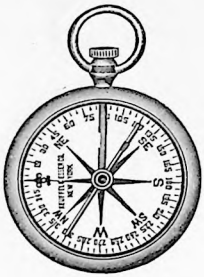
5613 R. Pocket Compass, nickel silver, watch-pattern hunting case, 1¾ in., metal dial, silvered, and graduated every 2°, numbered in quadrants every 10°. Edge-bar needle, weighted at end; with jeweled center and stop. Radium luminous indicators for night observation. . . . . each $

POCKET COMPASSES.

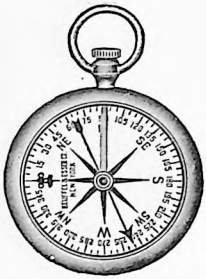
WATCH PATTERN, OPEN FACE.



No. N 5622.



No. 5623.



No. 5625.

N 5622. Pocket Compass, open face, nickel silver case, 1⅝ in., floating dial graduated every 5°, numbered every 15° from 0 to 360°; with jeweled center and stop . . . . . each $

5623. Pocket Compass, open face, nickel silver case, 1¾ in., etched metal dial, silvered, graduated every 5°, numbered every 15° from 0 to 360°. Edge bar needle, weighted at north end; with jeweled center and stop . . . . . each $

5625. Pocket Compass, like No. 5623, but flat needle, with jeweled center and stop . . . . . each $



No. N 5622 R.



No. 5628.



No. 5629.

N 5622 R. Pocket Compass, like No. N 5622, but with radium luminous indicators for night observation . . . . . each $

5628. Pocket Compass, open face, 1⅜ in., with knob and ring, black finish, card dial graduated every 5°, numbered every 15° from 0 to 360°. Flat needle without stop; jeweled center. . . . . each $

5629. Pocket Compass, like No. 5628, but without knob and ring, each $

HAND LEVELS.



No. 5700.

5700. Locke's Hand Level, nickel silver, with draw to eyepiece, 5 in.; in leather pouch . . . . . each $

5701. Locke's Hand Level, Brass with draw to eyepiece, 5 in.; in leather pouch . . . . . "

5702. Locke's Hand Level, Brass, plain, 5 in.; in leather pouch . "

Nos. 5700-5701 have magnifying lens for the bubble at the end of the draw.



Diagram, showing bubble in field of view.



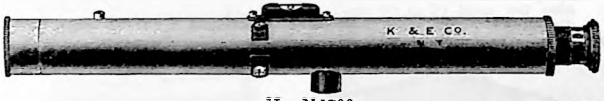
No. 5703.

5703. K & E Patent Hand Level, brass, square tube, 5 in.; in leather pouch, ... each $

In No. 5703 the reflector is a narrow prismoid, crossing the middle of the field of view, so that the field appears on both sides of the reflected bubble, as shown in the above diagram. As the lower surface of the tube is flat and parallel to the axis of the spirit level, this hand level can be used also as a contact level.

The Hand Level is a great help in chaining accurately and quickly.

STADIA HAND LEVEL (Telescopic).



No. N 5706.



Appearance of field.



No. 5348-2.



No. 5375 L. (½ size)

N5706. Stadia Hand Level, telescope 10 in., stadia hairs fixed, ratio 1:100, object-glass 1 in.; magnifying power about 7 diameters; with ball joint and socket, (No. 5348-2, page 351); in plain morocco Case. . . . . each $

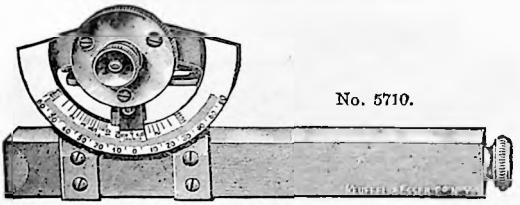
5706 S. Stadia Hand Level, like No. N5706, but in leather Sling Case "

5375 L. Micrometer Leveling Attachment for Nos. N 5706 and 5706 S "

The Stadia Hand Level has an achromatic erecting 10-inch telescope with 1-inch objective. The objective is drawn out for focusing and the eyepiece is adjustable for defining the stadia hairs. This instrument will be found very useful for preliminary surveys, cross-sectioning, railroad construction work, exploration of streams for water power, etc. When set on a staff or tripod, a fairly accurate line of levels can be run. It is easily carried, as it weighs scarcely 1½ pounds. In connection with a flexible leveling rod it constitutes a good outfit for preliminary work, on account of its light weight and ease of manipulation.

For Flexible Leveling Rods, see page 403.

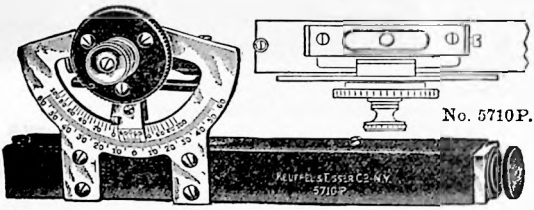
ABNEY LEVELS.



No. 5710.

5710. Abney Reflecting Level or Pocket Altimeter, 5 in., improved, with arc graduated to degrees for 60°, vernier reading to 10 minutes, gradients 1:1 to 1:10 in both directions; in plain leather case with belt loop, ... each $

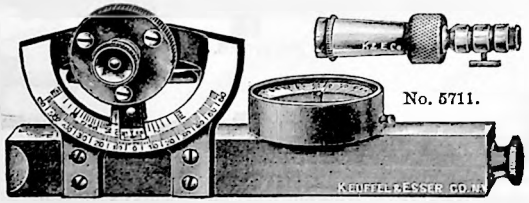
5710S. Abney Level No. 5710, but in sewed leather Sling Case . . "



No. 5710P.

5710P. Abney Reflecting Level or pocket Altimeter, 5 in., improved, with arc graduated to degrees for 60°, vernier reading to 10 minutes, also per cent of angle reading to 5% from 0 to 100% in both directions; in plain leather case with belt loop . . . . . each $

5710PS. Abney Level No. 5710 P, but in sewed leather Sling Case "



No. 5711.

5711. Abney Reflecting Level or Pocket Altimeter, 5 in., arc graduated like No 5710, bar-needle Compass 1¾ in., ball joint and socket No. 5348-1 for Jacob staff mounting; in plain leather case with belt loop, ... each $

5711S. Abney Level No. 5711 but in sewed leather Sling Case . . "

MICROMETER LEVELING ATTACHMENT.

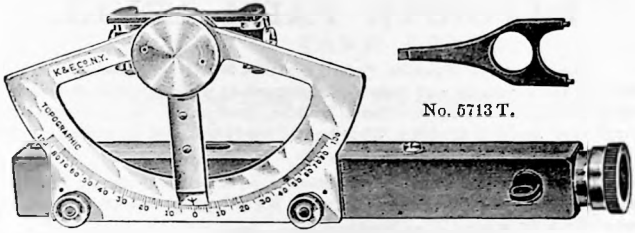


No. 5714.
(¼ size.)

5714. Micrometer Leveling Attachment (for Abney Levels, etc.) bronzed brass, in leather Case . . . . . each $

For Stadia Hand Transit, see page 354.
For Flexible Leveling Rods, see page 403.

K & E TOPOGRAPHIC ABNEY LEVEL.



No. 5713 T.

5713 D. Topographic Abney Level, arc in degrees . . . . . each $
5713 P. do. do. do. arc in per cent of grade . . "
5713 C. do. do. do. chainage correction arc . . "
5713 T. do. do. do. topographic arc . . . . . "
Extra Limbs with single graduations . . . . . "
Extra Limbs with any two graduations, to order only . . . . . "
5713½. Topographic Trailer Tape . . . . . "

The K & E Topographic Abney Level, as made by us for the U. S. Forest Service, is an improved form of Abney Level. It is larger than an ordinary Abney Level.

The Topographic Trailer Tape is a steel tape ½ in. in width and about 2½ chains in length. On one side it has etched graduations every link for the first two chains and brass sleeves at the zero, one-chain and two-chain mark. Beyond the two-chain mark extends a trailer with graduations proportionated to the graduations of the Topographic Arc.

In using the Topographic Arc and Trailer Tape, take a slope reading on the Arc and with the Trailer Tape measure on the slope two chains and as many graduations on the trailer as the arc reading shows. This distance measured on the slope equals a horizontal distance of two chains.

For very steep slopes, the reverse side of the tape is used. This side of the tape has etched graduations every link for one chain. Beyond the one-chain mark extends a long trailer which is used to measure the distance which corresponds to the horizontal distance of one chain.

MILITARY CLINOMETER.





Appearance of field.

No. 5721.



5721. Military Clinometer as made by us for the U. S. Army, bronzed case 2¾ in. diam., sensitive gravity (pendulum) clinometer, graduated 45° in both directions to single degrees, numbered at every 5 degrees, with automatic stop; in sewed leather Case with belt loop; Directions . . . . . each $

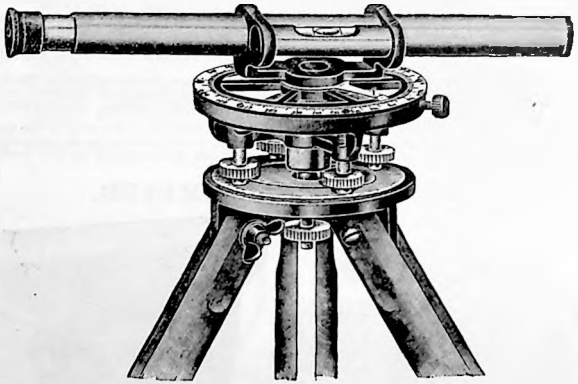
The scale reading and the sighted object are seen simultaneously (see cut). The instrument has a fiducial edge (foot) for use as a contact clinometer and a wire loop for attaching a carrying strap.

FAVORITE FARM LEVEL.

Our Improved Favorite Farm Level No. 5691 is designed to meet the demand for a reliable and durable instrument at a price within the reach of every Farmer, Landscape Gardener, Builder, Roadmaker, etc., to whom it will prove very useful in draining, ditching and roadwork, and for laying out and terracing parks, gardens, farm lands, etc.

It is sturdy and simple in construction, so that it will remain in adjustment and withstand the wear of daily use for a long period of time without requiring attention.

The printed Description of the Instrument and plain Directions for its Use are free from technical terms and written expressly for those who are not surveyors. By following these instructions, good results can easily be obtained even by those who have had no professional training and who are not familiar with land surveying.

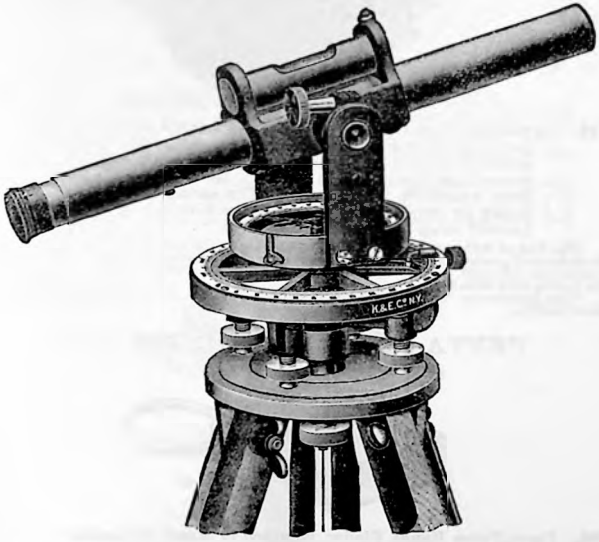


No. 5691.

5691. Favorite Farm Level. Telescope 10 in., with good lenses, showing objects erect; Magnifying Power about 8 diameters; with cross hairs; spirit level to telescope, graduated on the glass; horizontal circle graduated to single degrees and numbered from 0 to 360 degrees, revolving arm with index; instrument complete in wooden box with plumb bob; **wooden leveling rod 5 ft. extending to 9½ ft., divided into feet, inches and quarter inches, with target;** split leg tripod and directions . . . . . each $

FAVORITE FARM LEVEL

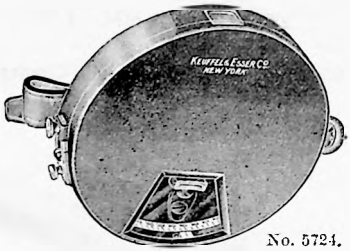
with Tilting Telescope and with Compass.



No. 5694.

5694. Favorite Farm Level with Tilting Telescope and Compass. Telescope 10 in., with good lenses; showing objects erect. Magnifying Power about 8 diameters. Horizontal circle graduated to degrees and numbered from 0 to 360 degrees; revolving arm with index. Compass Needle about 2½ in.; compass circle graduated to degrees. Spirit Level on telescope. Instrument complete in wooden box, with lockhooks and metal handle, plumb bob, (6 foot flexible) Leveling Rod No. 6335 S (page 403), and split tripod; . . . . . each $

HYPSOMETER AND GRADEMETER.



No. 5724.

5724. Hypsometer and Grademeter as manufactured by us for the U. S. Forest Service; bronzed brass case $3\frac{5}{8} \times 1\frac{1}{4}$ in., sensitive gravity (pendulum) clinometer; graduated to percentage of angle, from 0 to 50% for depression and from 0 to 200% for elevation. The spring stop is released by pressing knob; sliding lock for spring stop. Leather strap handle; with directions . . . . . each $

The line of sight passes through the diameter of the box, from a peep sight in one side to a small glazed window in the opposite side. A segment of the cover, closed by transparent celluloid, admits light to the graduations, which are seen simultaneously with the sighted object.

This instrument was designed and patented by Mr. F. G. Plummer of the U. S. Forest Service.

PENTA-PRISM RANGE FINDER.



No. 5745.

5745. Penta-Prism Range Finder, mounted in metal; in Leather Case, with Directions . . . . . each $

No. 5745 is a pentagonal prism, (like No. 5765, page 370,) but the ocular side has two faces, of different angles, one of which is alternately exposed by shifting the sliding shutter. Distances up to over two miles can be determined from the point of observation with sufficient accuracy for many of the requirements of the surveyor or military officer. The method of using is extremely simple and very easily acquired with but little practice. Complete directions are furnished with the instrument. To obtain the distance sought, the base line, as determined by the prism, is measured and multiplied by 50 (°3°). The angles of the prism are ground so accurately that no tables are required. Right angles are determined with this prism with great accuracy in the usual way.

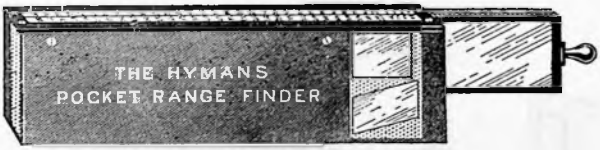
TAPE FOR MEASURING THE BASE LINE.

7482Y. K & E Woven Tape, length 20 yards, graduated to read 1000 yards by single yards . . . . . each $

This is a **K & E** Woven Tape, 3/8 in. wide, stout bent leather case, large center, folding handle, all mountings nickelplated, end reinforced with leather. The line is 20 yards long and graduated on a scale of 1:50 to read direct up to 1000 yards by single yards.

The tape in its case measures about 3-5/8 x 5/8 in. and weighs about 9 ozs. Its compactness and light weight make it convenient for carrying in the pocket.

HYMAN'S PATENT POCKET RANGE FINDER.



No. 5746.

5746. Pocket Range Finder, in leather case, with Directions, . . each $

No 5746 is a prismatic range finder which can be used to ascertain:-
The distance of any object by means of a short base of known length:
The distance of an object of known size or height, with one observation, from one position only;
The distance between two inaccessible points:
The instrument can also be used as an optical square for setting off right angles and for many other similar purposes.

The patent Pocket Range Finder is 3x1¼x¾ in. and weighs 4 ozs. Results correct within 5% have been obtained from a 10 yd. base up to 2000 yds. in clear weather. Facile use of the instrument is readily acquired; no technical knowledge is necessary. Complete directions furnished with each instrument.

ANGLE MIRRORS.

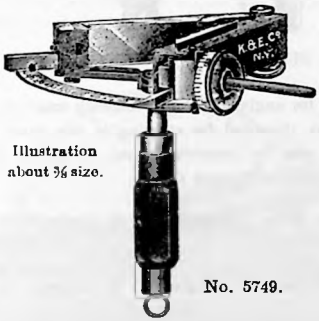


Illustration about ⅔ size.

No. 5749.

5749. Adjustable Folding Angle Mirror, arc graduated to degrees with Micrometer screw reading to minutes, folding ebony Handle; velvet lined morocco Case, with Directions . . . . . each $

This Angle Mirror has the advantage that the angle of the mirrors is not fixed, but adjustable. It is determined by an arc graduated from zero to 100 degrees, figured in accordance with the angle of the sighted point, being consequently double the angle of the mirrors. With this instrument offsets may be laid down at any angle up to 100 degrees from a given base, and distances to inaccessible points may be determined by measuring base and angle, when distance = base × tangent of angle. This computation for distance can also be worked out in a very simple manner by means of the slide rule.

This Angle Mirror will be found very useful, not only for the Surveyor and Civil Engineer, but also for the Military Officer, Traveler, etc.

ANGLE MIRRORS AND ANGLE PRISMS.



Illustration ½ size.

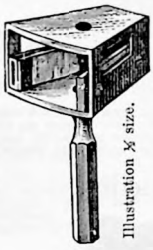


Illustration ½ size.

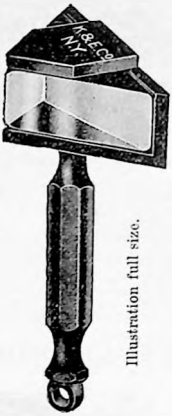


Illustration full size.



Illustration ½ size.

5750. 5751. 5762. 5765.

5750. Angle Mirror, for angles of 90 degrees, with small plumb bob, which is threaded for stowing in the handle. The handle can be unscrewed and stowed in frame of instrument; in Pocket Case . . . . . each $

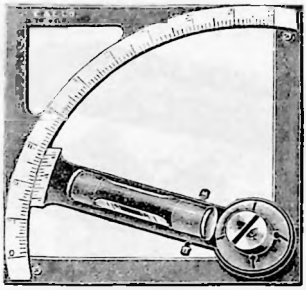
5751. Angle Mirror, plain, for angles of 90 degrees; in Pocket Case . . . . . each $

5762. Rectangular Prism, for angles of 90 degrees; in Pocket Case . . . . . each $

5765. Pentagonal Prism, for angles of 90 degrees, with detachable Handle; in Pocket Case . . . . . each $

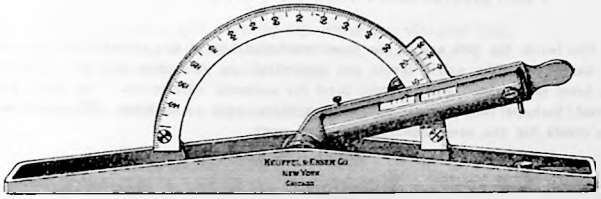
5765. Of the five faces of the prism two are polished and open. The longer two of the other faces are polished and silvered and covered by the casing. The fifth (short) face has no optical function. By this novel optical construction the reflected immovable image is much more distinct and much better illuminated than in triangular prisms, while its size is about twice that produced by the latter. These pentagonal prisms are therefore, far superior to triangular prisms of similar size and give more accurate results, with easier manipulation.

CLINOMETERS.



No. 5805.

5805. Clinometer or Slope Level, bronzed, square frame 4 in., with silvered arc graduated to degrees, vernier reading to 5 minutes, fine adjustable spirit level graduated on the glass; in mahogany Case . . . . . each $

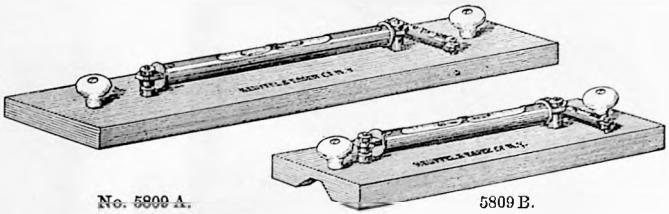


No. 5808.

5808. Combined Level and Clinometer, bronzed, base 9 in., silvered arc 4½ in. diameter, graduated to degrees, vernier reading to 5 minutes, fine adjustable spirit level graduated on the glass, arm with clamp screw; in mahogany Case . . . . . each $

This is a very practical level for Civil Engineers, Architects, Machinists, Builders and others. It can be applied directly in mounting machinery, construction material etc., or it can be used on a straightedge to determine the slope of ground, in laying rails and for other similar purposes.

LEVELS.



No. 5809 A. 5809 B.

5809 A. Extra Fine Adjustable Level, iron base 18×4×1 in., spirit level 9 in., graduated on the glass and ground to a sensitiveness of about 20 seconds of arc per graduation, weight about 13 lbs.; in hardwood Case, . . . each $

5809 B. do. do. iron base 12×3×1 in., spirit level 6 in., graduated on the glass and ground to a sensitiveness of about 25 seconds of arc per graduation, weight about 5 lbs., grooved base . . . . . "

The levels No. 5809 are of the finest workmanship, of the greatest precision, and very sensitive. The spirit levels are graduated on the glass and are adjustable. Each level is provided with a cross level for accurate adjustment. No. 5809 B has a grooved (V-shape) base for use on round surfaces, such as shafting. We recommend these levels for the most exacting kind of work.

No. 5810.

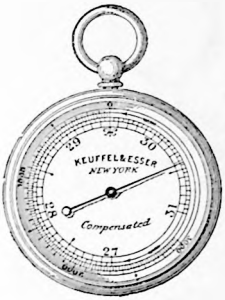


5810. Fine adjustable Level, iron base 8 in., sensitive spirit level graduated on the glass, base with side braces to make it more rigid, level vial 3½ in.; in Case, ... each $

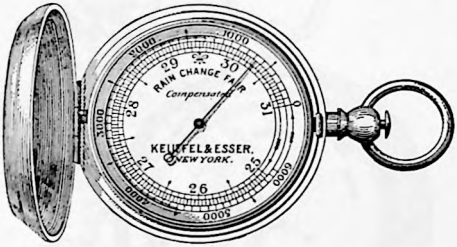
5811. do. do. do. base 12 in., level vial 6 in., " "

ANEROID BAROMETERS.

FOR MEASURING ALTITUDE AND ATMOSPHERIC PRESSURE.



No. 5855.



5871.

5850. Watch pattern, gilt case 1¾ in. diameter, silvered dial, revolving altitude scale 8000 feet; in morocco Case, each $

5855. Watch pattern, gilt case 1¾ in. diameter, silvered dial, revolving altitude scale 3000 feet, compensated for temperature; in morocco Case . . . . . "

5856. Like No. 5855, but altitude scale 6000 feet . . . . . "

5857. " " 5855, " " " 12000 " . . . . . "

5858. " " 5855, " " " 18000 " . . . . . "

5870. Watch pattern, nickel hunting case 2 in. diameter, silvered dial, revolving altitude scale 3000 feet, compensated for temperature . . . . . "

5871. Like No. 5870, but altitude scale 6000 feet . . . . . "

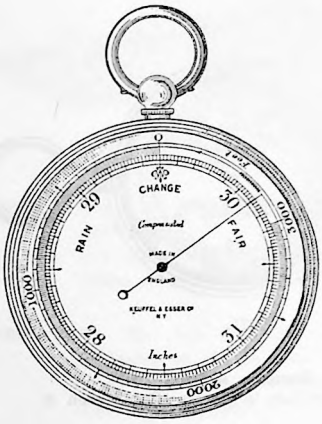
5872. " " 5870, " " " 12000 " . . . . . "

5873. " " 5870, " " " 18000 " . . . . . "

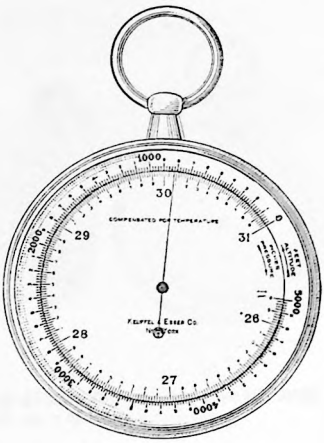
PLAIN DIRECTIONS FOR MEASURING HEIGHTS FURNISHED WITH EACH INSTRUMENT.

ANEROID BAROMETERS.

FOR MEASURING ALTITUDE AND ATMOSPHERIC PRESSURE.



No. 5880.



5880½.

5880. Pocket pattern, brass case 2¾ in. diameter, silvered dial, revolving altitude scale 3000 feet, compensated for temperature, in morocco Case . . . . . each $

5881. Like No. 5880, but altitude scale 6000 feet . . . . . "

5882. " " 5880, " " " 12000 " . . . . . "

5883. " " 5880, " " " 18000 " . . . . . "

5880½. Pocket pattern aluminum case 2⅞ in. diameter, silvered dial, revolving *equidistant altitude* scale 5000 feet, compensated for temperature. In sewed leather sling Case with shoulder straps . . . . . each $

5881½. Like No. 5880½, but altitude scale 10000 feet . . . . . "

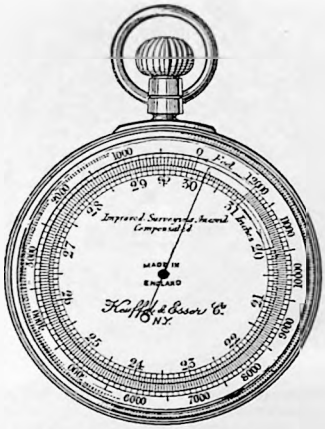
5882½. " " 5880½, " " " 16000 " . . . . . "

Nos. 5880½-5882½. The advantage of this type barometer lies in its equidistant altitude scale. In the old type instrument the unit of division of the altitude scale decreased commensurately with the increase in altitude: the altitude scale of this new type barometer is graduated uniformly throughout its entire length, thus accuracy is not dependent upon the section of the scale which may be read.

PLAIN DIRECTIONS FOR MEASURING HEIGHTS FURNISHED WITH EACH INSTRUMENT.

ANEROID BAROMETERS.

FOR MEASURING ALTITUDE AND ATMOSPHERIC PRESSURE.



No. 5892.

5890. Pocket pattern, bronzed case $2\frac{3}{4}$ in. diameter, silvered dial, revolving altitude scale 3000 feet, operated by rack and pinion, revolving pointer (index) operated separately by milled ring, compensated for temperature; in sewed leather Sling Case . . . . . each $

5891. Like No. 5890, but altitude scale 6000 feet . . . . . "

5892. " " 5890, " " " 12000 " . . . . . "

5893. " " 5890, " " " 18000 " . . . . . "

As the altitude scale and the pointer of Nos. 5890 to 5893 have separate actions, these instruments can also be used as with fixed altitude scale.

Sewed leather Sling Cases for Barometers Nos. 5890, 5891, 5892 and 5893. . . . . each $

5900. English Government pattern, brass case 5 in. diameter, silvered dial, graduations on raised ring, fixed altitude scale 6000 feet, revolving pointer, compensated for temperature, curved thermometer; in morocco Case. . . . . each $

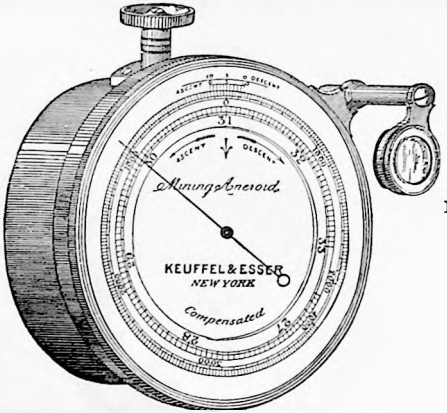
5902. Like No. 5900, but altitude scale 12000 feet . . . . . "

5904. " 5900, " " " 18000 " . . . . . "

PLAIN DIRECTIONS FOR MEASURING HEIGHTS FURNISHED WITH EACH INSTRUMENT.

SURVEYING BAROMETERS.

FOR MEASURING ALTITUDE AND ATMOSPHERIC PRESSURE.



No. 5920.

5910. Surveying Barometer, bronzed case 3 in. diameter, silvered dial, graduations on raised ring, fixed altitude scale 14800 feet, vernier scale operated by rack and pinion, reading to 5 feet, compensated for temperature, adjustable reading lens; in leather Sling Case . . . each $

5915. Surveying Barometer, bronzed case 5 in. diameter, silvered dial, graduations on raised ring, fixed altitude scale 5000 feet, vernier scale operated by rack and pinion, reading to 1 foot, compensated for temperature, adjustable reading lens; in leather Sling Case . . . "

5916. Like No. 5915, but altitude scale 14900 feet, reading to 2 feet, "

5920. Mining Barometer, bronzed case 5 in. diameter, silvered dial, graduations on raised ring, fixed altitude scale 2000 feet below and 4000 feet above sea level, vernier scale operated by rack and pinion, reading to 1 foot, compensated for temperature, adjustable reading lens; in leather Sling Case . . . . . "

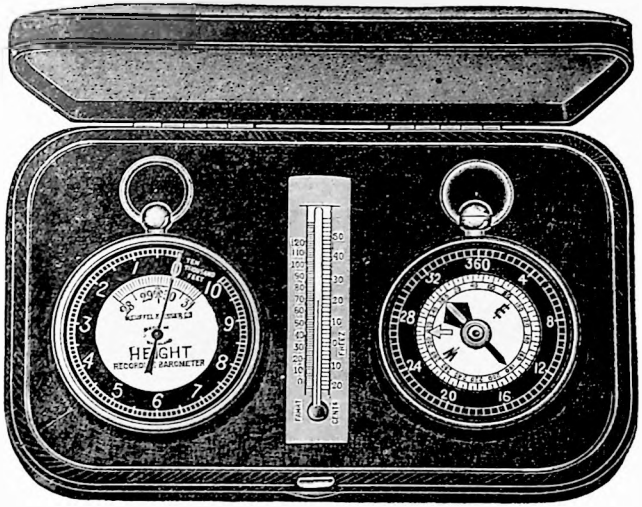
Sewed leather Sling Cases for Nos. 5910, 5915, 5916 and 5920 "

The instruments Nos. 5910 to 5920 are constructed especially for ascertaining slight variations in gradients, levels, etc. Their extreme sensitiveness is of great value in mining and surveying work generally. A valuable improvement in these instruments is an arrangement of the scale of altitude permitting the reading by vernier, formerly impracticable owing to the usual altitude scale being a gradually diminishing one to which a vernier could not be applied. In the above instruments the action has been adjusted to give accurate readings upon a uniform scale of altitudes, the barometrical scale of inches having been made progressive so as to afford the correct relative readings with the scale of altitudes.

These instruments are also constructed for measuring greater altitudes, i. e., up to 20,000 feet, but with these higher scales the measurements cannot be made quite so minute as with the more open scales.

PLAIN DIRECTIONS FOR MEASURING HEIGHTS FURNISHED WITH EACH INSTRUMENT.

ANEROID BAROMETERS.

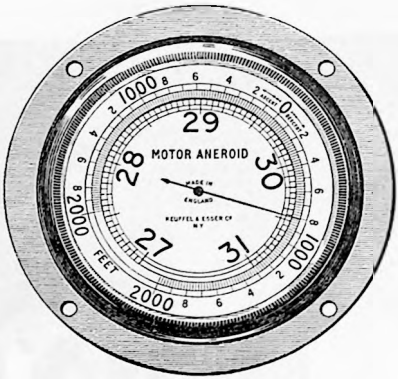


No. 5922.

5922. Aneroid-Magnetic Compass set, consisting of:-
a highest grade aneroid barometer, silvered dial, 1¾ in. diameter, revolving altitude scale 10,000 feet; a liquid magnetic compass, floating dial 1¾ in. diameter with radium luminous marks on the North point of the dial, on the fixed arrow on the glass cover, and on the zero point of the revolving azimuth scale; a small thermometer. Set packed in fine morocco case with folding stand . . . . . each $

This is a fine set for travelers, automobilists, aviators, etc.

AUTOMOBILE ANEROID.



No. 5924.

5924. Automobile aneroid, dial 2¾ in. diameter, heavily nickel-plated, revolving altitude scale, graduated to 2,000 feet, numbered every 200 feet, and reading 2,000 feet ascent and 2,000 feet descent. . . . . each $

POCKET THERMOMETERS.



No. N 5930.

N 5930. Pocket Thermometers, mercurial, 5 in., Fahrenheit, opal glass scale reading to 2 degrees; in nickelplated brass Case . . . . . each $

BAROGRAPHS, THERMOGRAPHS, HYGROGRAPHS.

These Self-recording instruments are for many purposes preferable to reading instruments. They have been perfected, so that they are now reliable and correct.

The sensitive member of these instruments expands or contracts under varying conditions of pressure, temperature, or humidity of the atmosphere and imparts its motion to a multiplying lever. A pen automatically records on a graduated chart which is operated by clockwork.

POCKET BAROGRAPHS.



No. 5935.

No. 5935 Closed. Open.

5935 Pocket Barograph, compensated for temperature, reading to 4000 feet; in morocco-covered metal Case. Barograph, with bottle of Ink and 50 graduated Charts; in polished mahogany Box . . . . . each $

5936. Like No. 5935, but reading to 7800 feet . . . . . "

5937. " " " " " 15000 " . . . . . "

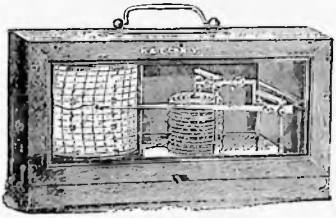
These self-recording aneroid barometers are of great advantage in many cases where the bulk and weight of the usual barographs forbid their use.

The Pocket Barograph measures 4¾ x 3⅝ x 1¾ in. and weighs about one pound. The metal, morocco covered case has a glass inserted in the cover over the chart, for taking readings without opening the case.

The chart is so ruled that it represents the time by half-hours, for 24 hours, and the pressure in feet of altitude. The pen makes contact every two minutes. The instrument also indicate atmospheric changes, like other aneroids.

Notwithstanding its small size the Pocket Barograph is a relatively reliable instrument.

RECORDING INSTRUMENTS.

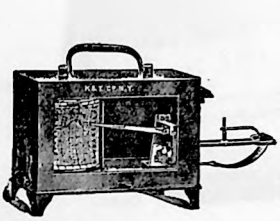


No. 5941.

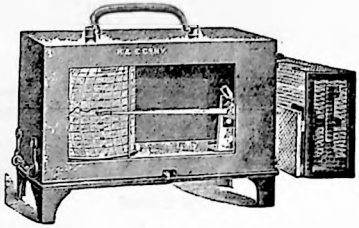
5940. Barograph, small size, registering one week; from 28 in. to 31 inch atmospheric pressure, by twentieths inches. Series of 5 vacuum boxes, cylinder 2½ in. diameter ×2¾ in. high. In polished mahogany Case with handle, hinged cover with glass-paneled front. With Charts for one year and bottle of Ink . . . . . each $

5941. do. do. but large size; series of 8 vacuum boxes, cylinder 3⅝ in. diameter × 3⅝ in. high . . . . . "

5941 H. Gimbal Hook for suspending Barograph from ceiling on shipboard . . . . . "



No. 5942.



5943.

5942. Thermograph, registering one week; from 0 to 100 degrees Fahrenheit by 2 degrees; cylinder 2¾ in. diameter × 2¾ in. high. In weatherproof metal case with handle and glass-paneled front. With Charts for one year and bottle of Ink . . . . . each $

The curved tube outside of the case contains alcohol and is hermetically sealed. The alcohol expands and contracts under changes of temperature, thereby changing the curve of the tube and thus imparting motion to the recording lever.

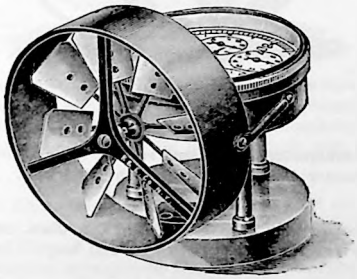
5943. Hygrograph, registering one week; from 0 to 100 per cent. of moisture by single per cent. Cylinder 3⅛ in. diameter × 3⅝ in. high. The sensitive hairs are protected by a wire cage. Instrument in weatherproof metal case with glass-paneled front and handle. With Charts for one year and bottle of Ink . . . . . each $

The sensitive member of this instrument consists of a bundle of fine hair, which expands and contracts under variations of humidity, and imparts the resultant motion to the recording mechanism.

Extra charts for period of one year for Nos. 5935, 5936, 5937, per set $
do. do. do. for Nos. 5940, 5941, 5942, 5943 " "

ANEMOMETERS.

Anemometers are used for the measurement of the velocity of air currents in mines, tunnels, sewers, public buildings, hospitals, etc. As now constructed by us, these instruments embody a number of important mechanical improvements, among which may be mentioned the **zero setting arrangement**. Setting the instrument to zero before each reading does away with the necessity of taking a previous reading into consideration and lessens the liability of error. Each instrument is carefully calibrated and provided with a calibration curve. Our instruments have jewel bearings and are constructed to measure air velocities **from 200 to 2000 feet per minute** (except **No. 5966Z**, which measures to **6000 feet** and **No. 5967**, which measures **from 75 to 400 feet**). They should not be used in temperatures exceeding 300° F. As a rule, our anemometers (except No. 5966Z, and No. 5967) are calibrated from 200 to 1000 feet.

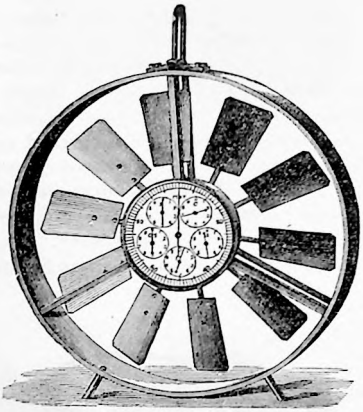


No. 5952.

5950. Improved Portable Anemometer with disconnector, vane 2½ in. diam., registering to 1000 feet; in polished mahogany Case. . . . . each $

5952Z. Improved Portable Anemometer like No. 5950, but registering to 10,000,000 feet and with Zero Setting arrangement . . . . . "

ANEMOMETERS.



No. 5965 Z.

5953. Biram Anemometer, 3 in. diam., reading to 1000 feet, with disconnector; in leather pouch with belt loop. . . . . each $

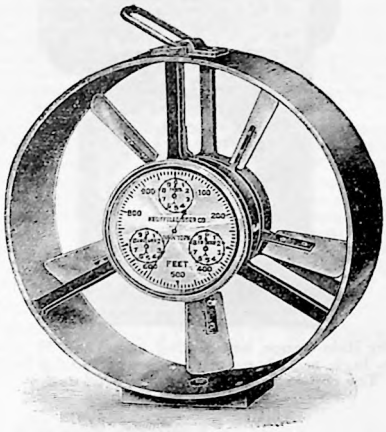
5957. Biram Anemometer, like No. 5953, but 4 in. diam., reading to 1000 feet; in leather pouch with belt loop. . . . . "

5958 Z. Biram Anemometer, like No. 5953, but 4 in. diam., reading to 100,000 feet, with Zero Setting arrangement; in leather pouch with belt loop. . . . . "

5963. Biram Anemometer, like No. 5953, but 6 in. diam. reading to 1000 feet; in leather pouch with belt loop . . . . . "

5965 Z. Biram Anemometer, like No. 5953, but 6 in. diam., reading to 10,000,000 feet, with Zero Setting arrangement; in leather pouch with belt loop. . . . . "

HIGH SPEED ANEMOMETER.



No. 5966 Z.

5966 Z. High Speed Anemometer, for measuring air velocities up to 6000 feet per minute; 6 in. diameter, registering to 1,000,000 feet by 10 ft. intervals, with disconnector and zero-setting arrangement; in leather pouch with belt loop. . . . . each $

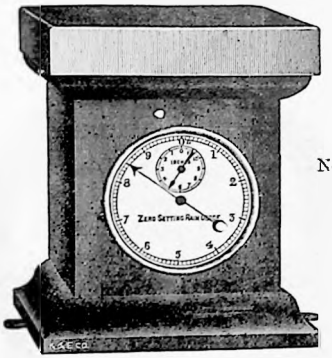
The K & E High Speed Anemometer is intended for use in measuring the velocities of air blasts or gases moving at high velocities, such as are encountered in blast furnace work or similar operations. The most substantial and durable construction is employed for all parts, insuring reliable results. It may safely be used in temperatures up to 300° F.

LOW SPEED ANEMOMETER.

We make an instrument similar to No. 5963, but more delicate in construction, for measuring velocities from 75 to 400 feet per minute. This instrument was developed for measuring air currents at the registers of heating and ventilating systems, in schools, public buildings, etc.

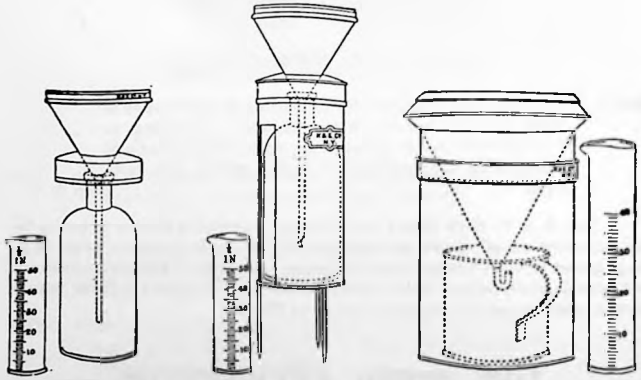
5967. Low Speed Anemometer, in leather pouch with belt loop, each $

RAIN GAUGES.



No. 5971.

5971. Registering Rain Gauge, zero-setting, metal case 8½ × 8½ in. × 10¼ in. high, records up to 12 inches of rainfall by 100ths inches. The copper receiver is of improved design . . . each $



No. 5980G. 5980. 5982G. 5982. 5984. 5984G.

5980. Rain Gauge, Howard's model, simple construction, with graduate reading to $\frac{1}{100}$ in., ... each $

5982. do. Symon's model, with prongs to prevent tipping, with graduate reading to $\frac{1}{100}$ in., ... "

5984. do. Glaisher's model, a very reliable instrument, with graduate reading to $\frac{1}{100}$ in., ... "

Extra Graduates	No. 5980 G.	5982 G.	5984 G.
each	$		

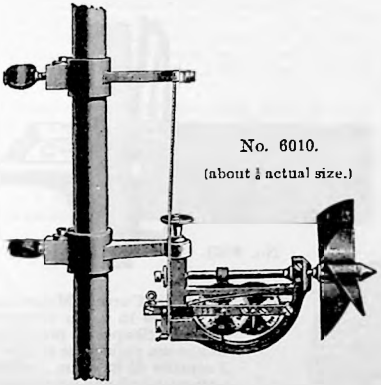
CURRENT METERS.

The current meters illustrated and described in the following pages represent the most improved instruments of this type, and in selecting them all the requirements of the Engineer and Hydrographer have been taken into careful consideration. With this type of instrument, only the velocity of the water parallel to the horizontal axis of the instrument is measured, thereby reducing to a minimum the disturbing influences of whirls and cross currents and making it possible to measure any desired component of the water's velocity, a feature that is of obvious importance.

Special attention is called to instruments Nos. 6019½ and 6025, which are provided with watertight contact chambers to avoid the liability of error due to short circuiting in salt water or water polluted with sewage.

Marked improvements have been introduced in the various constructive details. Wherever possible ball and agate bearings are used, and these are protected by the most approved means against the entrance of silt and other injurious substances. All parts subject to wear or liable to injury, are substantially constructed. Instruments are calibrated under actual conditions of use and furnished with constants for the calculation of results.

CURRENT METERS
WITH REGISTERING WHEELS.

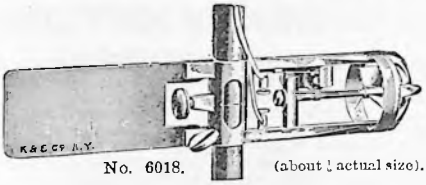


No. 6010.
(about ⅛ actual size.)

6010. Current Meter, pocket size: propeller 3 in. dia., pitch about 0.5 ft.; two graduated wheels registering to 1000 revolutions. The registering wheels can be thrown into and held in gear by a string attached to a lever, or they can be released and stopped by means of a cam operated by two strings and attached to the frame. The instrument fits on a pole of ¾ in. diameter. It can be taken apart and stored compactly in a morocco Case 9x4x1½ in. Weight 1½ lbs. . . . . each $

6010P. Pole for No. 6010, 9-foot steel tube, graduated to feet and tenths, in 3 sections, with steel point and detachable baseplate . . . . . "

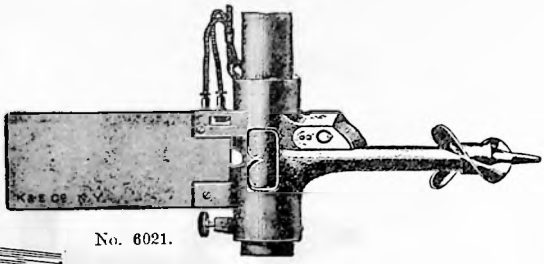
For Accessories, see page 392.



No. 6018. (about ½ actual size).

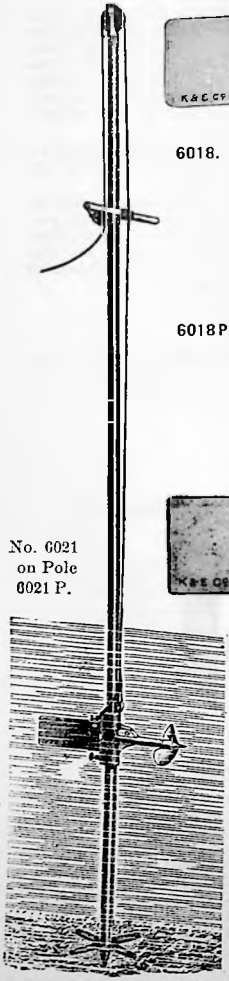
6018. Electrical Current Meter, small size, designed especially for measuring currents in shallow waters. Minimum depth of measurable water 3 in. This instrument is very convenient when traveling. Propeller 2½ in. dia., and about 0.45 ft. pitch. Propeller axis in agate bearings. Electrical contact for every 50 revolutions. Metal rudder about 3 × 5 in. Instrument fits on pole ¾ in. diameter. In polished hardwood box 3¾x4x8¾ in. with Pointer. Weight 3½ lbs. each $

6018 P. Pole for No. 6018, 9 foot steel tube, in 3 sections, graduated to feet and tenths, with steel point and detachable base plate, ... each $



No. 6021.

No. 6021 on Pole 6021 P.

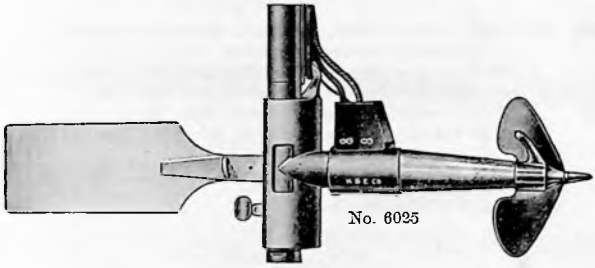


6021. Electrical Current Meter designed especially for use in water carrying silt, grass or leaves. Shape of propeller blades offers minimum resistance to the flow of water. Propeller 4¾ in. diam., pitch about 0.85 ft.; axis with ball and agate bearings. Contact every 25 revolutions. Meter fits on pole 1 in. diam. Instrument complete in hardwood Box, with 40 ft. reinforced electric cable, pulley, clamp and Pointer. Dimensions of Case 18 × 8½ × 5½ in. Weight about 12½ lbs. . . . . each $

6021 P. Pole for No. 6021, 16 foot steel tube in 2 sections, graduated to feet and tenths, with guide bar, steel point and detachable base plate. . . . . each $

For Accessories, see page 392.

MAGNETIC CURRENT METER.



No. 6025

6025. Electrical Current Meter with magnetic contact device. All contact points enclosed in hermetically sealed case and actuated from without by powerful permanent magnet mounted on end of propeller axis. Contact every 25th revolution or every single revolution as desired. Propeller 7½ in. diameter, pitch about 1.7 ft.; axis mounted in ball and agate bearings. Instrument fits on pole 1¼ in. diameter. The body of this instrument (carrying the propeller axis and contact chamber) can be unscrewed and attached to a hollow metal rudder to form a Floating Current Meter (see No. 6026).

Instrument complete, in hardwood Box, with 40 feet of reinforced electrical cable, pulley clamp and Pointer. Dimensions of case about 16 × 6½ × 9½ in. Weight about 23 lbs. . . . . each $

6025 P. Pole for No. 6025, 20-foot steel tube graduated to feet and tenths, in 2 sections, with guide bar, steel point and detachable baseplate . . . . . each $

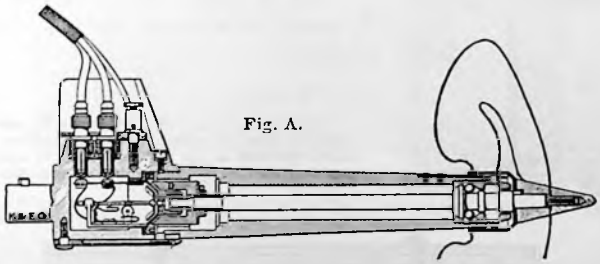


Fig. A.

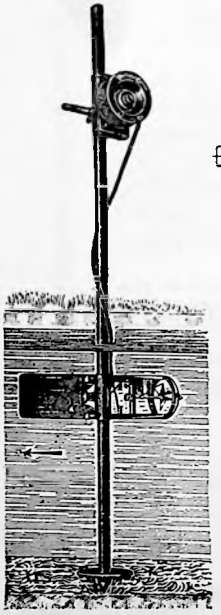
Figure A illustrates a cross section of No. 6025 showing the arrangement of shaft bearings, mounted bell-shaped magnet, and water-tight contact chamber. With this construction there is no possibility of short circuiting or disarrangement of the recording mechanism; the meter, therefore, is especially valuable for taking observations in harbors and tide waters. When used with Float No. 6026, observations can be taken at any depth with a high degree of accuracy.

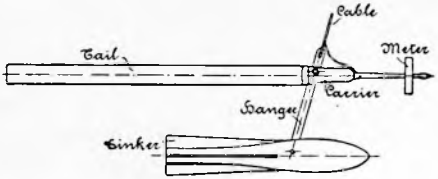
For Float for Current Meter No. 6025, see page 392.

CURRENT METER—TRAVELING OUTFIT.

6018½. Electrical Current Meter, small size, designed especially for measuring current in shallow waters. Minimum depth of measurable water 3 in. Propeller 2⅛ in. diameter, and about 0.45 ft. pitch. Propeller axis in agate bearing. Electric contact for every 25 revolutions. Metal rudder about 3x5 in. Instrument fits on pole ¾ in. diameter.

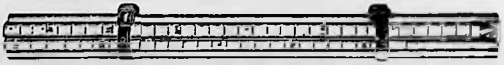
For illustration of Current Meter, see No. 6018, page 386.





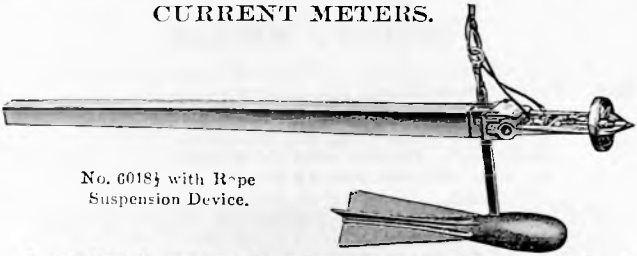
Rope-suspension device for Current Meter No. 6018½, composed of a carrier, a floating tail, (2 sections) 3½ ft. long of 1¼ x 1⅝ in. brass tubing, a hanger, a lead sinker of 5½ lbs. weight and 20 feet of cable with carabine swivel.

The electric battery furnished with No. 6018½ is made so that the telephone can be attached and either the bell or the telephone may be used for receiving signals. See illustration on page 890.



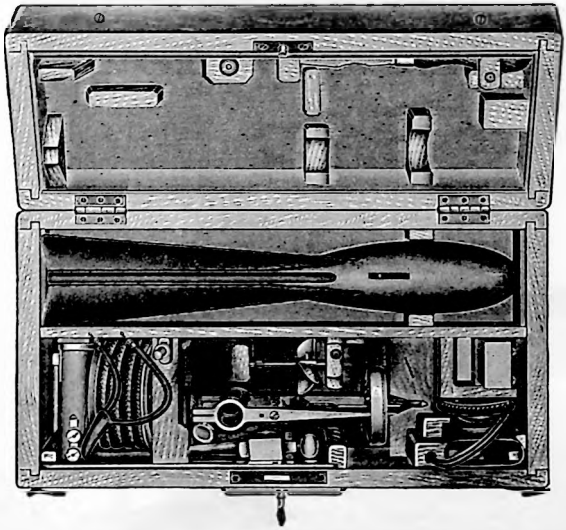
Pole for No. 6018½, 8 ft., steel tube ¾ in., in five sections with steel point and detachable base plate.

CURRENT METERS.



No. 6018½ with Rope Suspension Device.

Current Meter No. 6018½ may be fitted with a rope-suspension device and then be used for measurements to be made from bridges and other high points, provided the river is not very deep and runs at a moderate velocity.



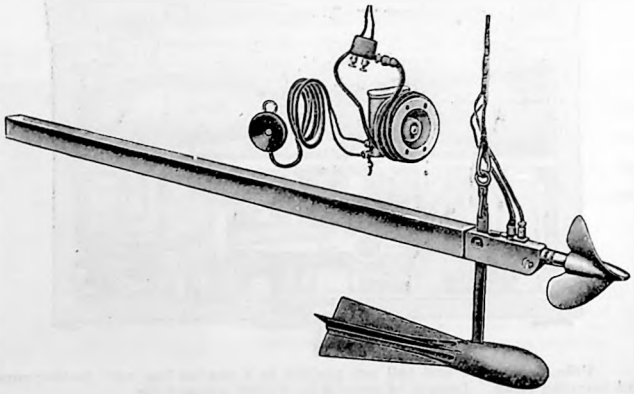
Pole, base plate and tail are packed in a canvas bag with leather caps and carrying strap. Length of cover 2 ft; weight about 8 lbs.

Current Meter, reserve axis and reserve propeller, electric battery with bell, reserve battery, telephone, pointer, connecting rod for tail of float, connecting piece for meter and tail, sinker of 5½ lbs., 20 ft. cable, screw driver, oil can, in case as shown in illustration. Size of wooden case about 5½ × 9 × 16 in., weight about 21 lbs. Price of complete outfit . . . . . each $

CURRENT METERS.

6019½. Electrical Current Meter with waterproof contact chamber. For use in salt or impure water where conductivity would produce short circuiting, and, consequently, errors in observations. Propeller about 5 in. diameter; axis in ball bearings. Propeller pitch 0.9 ft. One spare propeller 1.5 ft. pitch. Contact every five revolutions. Extra pin on contact wheel for contact every 10 revolutions. Extra contact wheel for short and long signals. Body of current meter smooth and compact with safety pin to prevent the propeller from striking the ground when meter is used on the pole. Pocket Battery, extra dry cell, electric bell and telephone. Twenty foot reinforced electric cable and clamp with pointer. Instrument fits on pole ¾ in. diameter (see illustration No. 6018½ page 388).

Pole for No. 6019½, 8 ft. steel tube ¾ in. in five sections, with steel point and with detachable base plate.

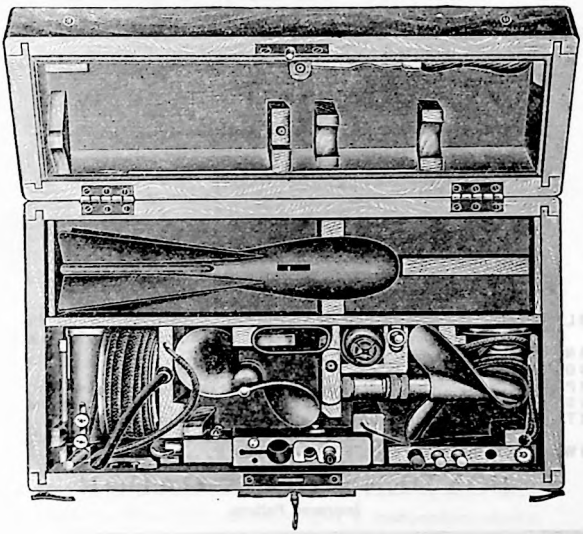


Rope-suspension device for Current Meter No. 6019½, composed of a carrier, a floating tail 8½ ft. long of 1¼ x 1⅝ in. brass tubing, a hanger, a lead sinker of 9½ lbs. weight and 20 feet of cable with carabine swivel. See also diagrammatic illustration on page 388.

CURRENT METERS.

Pole, base plate and tail are packed in a canvas bag with leather caps and carrying strap. Length of cover 2 ft. Total weight about 8 lbs.

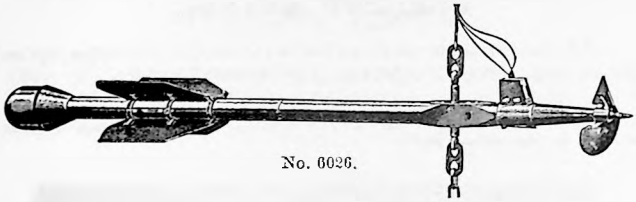
The electric battery is made so that the telephone can be attached and either the bell or the telephone may be used for receiving signals. For illustration of battery with bell, see pages 388 and 390.



Current Meter, reserve propeller, electric battery with bell, reserve battery, telephone, pointer, connecting rod for tail of float, sinker of 9½ lbs., 20 ft. cable, screw driver, oil can and bottle of oil, in case as shown in illustration. Size of wooden case about 5½ x 9 x 16 in., weight about 25 lbs. Price of complete outfit, ... each $

The axis of this Current Meter is stationary and the propeller rotates on it on ball bearings of hardened steel. These ball bearings guarantee a smooth running of the propeller; they will last indefinitely if given proper care. They are easily spoiled, however, through contact with water or sand and must be protected from all extraneous matter of this kind by filling with oil the space in which the bearing runs. Bearings can be exchanged, but proper precautions should obviate this necessity.

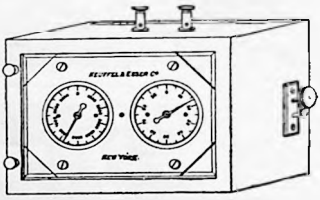
FLOAT FOR CURRENT METER.



No. 6026.

6026. Brass Float with movable Rudder, with Hooks for suspending and anchoring, for Meter No. 6025; in hardwood Case . . . . . each $

ACCESSORIES FOR CURRENT METERS.



No. 6028 L.

6028 L. Electric Register, 2 dials registering up to 10000 revolutions; in polished mahogany Case $4\frac{1}{2}$ x $6\frac{1}{4}$ x $3\frac{1}{4}$ in, with Switch, each $
6028 N. Electric Bell. . . . . "
6028 O. Dry Cells . . . . . "
6028 P. Electric Register, Bell and 4 Dry Cells; in hardwood Case "
6028 S. Insulated Copper Wire . . . . . per foot
6028 T. Lead weight, about 75 lbs., with chain for anchoring float No. 6026. . . . . each
6028 W. Canvas bags, for Nos. 6010 P. to 6021 P. . . . . "

BOYDEN'S HOOK GAUGE

Improved Pattern.



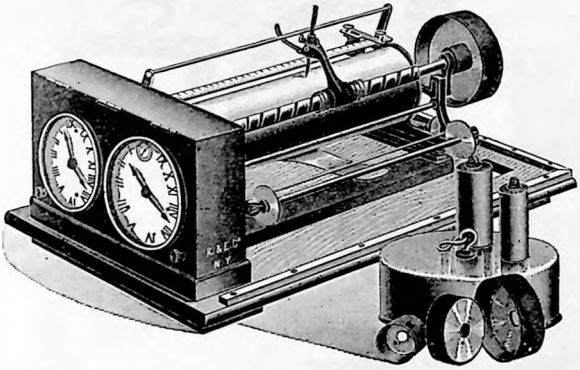
No. 6050.

6050. Boyden's Hook Gauge, latest improved pattern, mahogany frame, slide faced with nickel silver, graduated to 100ths ft., adjustable vernier reading 1000ths ft., with clamp, slow motion screw of nickel silver, hook and all mountings of brass. . . . . each $

Boyden's Hook Gauge for ascertaining the depth of water flowing over a weir or dam, consists of a scale 2 ft. long, graduated to 100ths ft. and sliding in the groove of a frame which also carries an adjustable vernier reading 1000ths ft. By means of this adjustable vernier the scale can be set to read exactly zero when the tip of the hook is level with the crest of the weir and all readings can be taken directly without the necessity of making a correction for initial reading. The lower end of slide is fitted with a movable brass hook, upper end with a micrometer screw.

SELF-REGISTERING TIDE GAUGE.

(C. & G. SURVEY MODEL.)



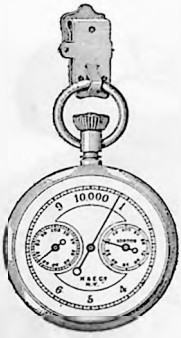
No. 6061.

6061. Self-registering Tide Gauge, as made by us for the U. S. Coast & Geodetic Survey, brass cylinder 13¼ in., 2 rollers for record paper, adjustable metal scale, 4 interchangeable brass pulleys, float with counterweight, 2 independent clocks; instrument complete, in strong hardwood Box, with Directions . . . . . each $

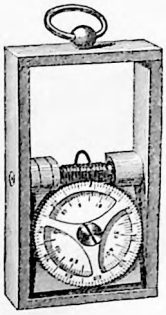
This is a very correct and reliable instrument. The registering pencil derives its motion from one of the clocks and records the tide as well as the time, the latter by an interruption in its mark at every hour. The travel of the periphery of the cylinder is 1 inch per hour. The 4 pulleys of different diameter (in the ratio 1:2:3:4) can be interchangeably attached to the end of the shaft carrying the pencil, so that the travel of the mechanism can be adapted to the extent of travel of the float.

6061 T. Record Paper for Self-Registering Tide Gauge (blank), per roll of 22 yards . . . . . $

PEDOMETERS. ODOMETERS.



No. 6905.



6910.

6900. Pedometer, watch pattern, nickel case, 1¾ in., registering 12 miles by ¼ miles . . . . . each $

6901. do. do. registering 50 miles by 80 yards "

Pedometers Nos. 6900 and 6901 register the distance walked. The hand advances in proportion to the length of stride, and the instrument is adjustable for length of stride by an easily accessible screw.

6905. Passometer, watch pattern, nickel case, 1¾ in., registering to 100,000 steps . . . . . each $

Passometer No. 6905 registers the number of steps walked and is not adjustable to length of stride. The distance walked can be computed from the number of steps registered.

6910. Odometer of Brass, with silvered dials, in dustproof leather Case with Straps . . . . . each $

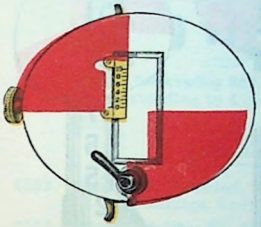
The Odometer is attached to the spokes of a wheel, near the hub. It registers the number of revolutions of the wheel up to 10,000, and the distance traveled is determined by multiplying the circumference of the wheel by the number of revolutions which the dial indicates.



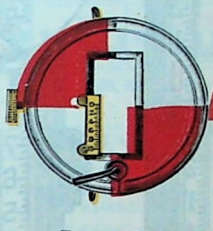
LEVELING RODS.



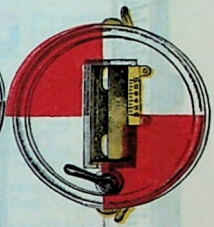
Our leveling rods are made with the same painstaking regard for precision and high quality which we bestow on our other surveying tools.



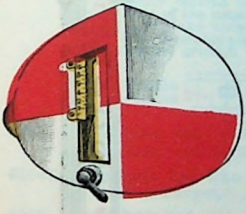
Target of Heavy Philadelphia Rods.

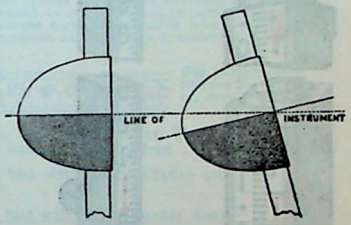


Target of Light Philadelphia Rods.



Target of New York Rods.





Thompson's Patent Angle Target.

This Leveling Rod Target is devised to insure the rod being held perpendicular to the observer's line of sight by giving him full control of its position and an efficient check upon the rodman. The horizontal dividing line of the target is carried over two surfaces placed at right angles to each other, thus showing a continuous and unbroken line only when the rod is held in vertical position.

The MICROMETER ARRANGEMENT for setting the target consists of an eccentric controlled by a handle placed at the lower edge of the target, which slides the target on an inner metal sleeve and permits of rapid and accurate setting. The brass mountings are very durable and of best design and workmanship.

SEPARATE TARGETS

with Patent Micrometer Arrangement, for K. & E. Co. Leveling Rods.

6298. Target for heavy Philadelphia Rods . . . . . each $
6298A. Target for light Philadelphia Rods . . . . . "
6298B. Target for New York Rods . . . . . "
6298C. Angle Target, Thompson's Patent, for Philadelphia Rods "
6298D. do. do. do. do. for New York Rods "

In ordering extra Targets for our rods, please give exact cross section of the rod for which they are intended, and state how rod is graduated, or give its catalogue number.

LEVELING RODS.



No. 6250.
English.



6252
Frisco.



6256.
Heavy Philadelphia.



6261.
Light Philadelphia.

LEVELING RODS.



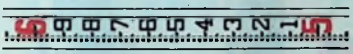
For pattern of rod see No. 6250 on opp. page.

6250. **English Self-reading Rod**, telescoping, graduated on the enameled wood, strong brass mountings, 5 feet, extending to 14 feet . . . . . each $



For pattern of rod see No. 6250 on opp. page.

6251. **English Self-reading Rod**, like No. 6250, but metric, 1.5 meter, extending to 4 meters . . . . . each $



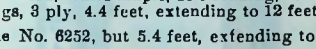
For pattern of rod see No. 6252 on opp. page.

6252. **Frisco Rod**, Patented, white maple, self-reading, stout brass mountings, 3 ply, 4.4 feet, extending to 12 feet . . . each $

6253. **Frisco Rod**, like No. 6252, but 5.4 feet, extending to 15 feet "

The Frisco Rods are very light and compact and, therefore, can be conveniently carried in railroad or trolley cars, in an automobile, etc., where rods of the usual pattern would be inconvenient to carry. Portability and light weight, compactness and short length when closed, make them desirable also for use in mines, in the woods or underbrush, or on obstructed ground.

Target scale reads to $\frac{1}{100}$ths foot.



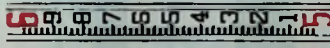
For pattern of rod see No. 6256 on opp. page.

6254. **Philadelphia Rod**, white maple, with Micrometer Target, Clamp and Vernier, 7 feet extending to 13 feet . . . each $

6254C. **Philadelphia Rod**, like No. 6254, but with plain Clamp and plain Target, ... "

6255. **Philadelphia Rod**, like No. 6254, but with Micrometer Angle Target, ... "

Vernier reads to $\frac{1}{1000}$ths foot.



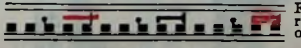
For pattern of rod see No. 6256 on opp. page.

6256. **Philadelphia Rod**, like No. 6254, but feet div. 10ths and 100ths, each $

6256C. **Philadelphia Rod**, like No. 6256, but with plain Clamp and plain Target, ... "

6257. **Philadelphia Rod**, " " 6255, " " " 10ths " 100ths, "

Target scale reads to 1 mm.



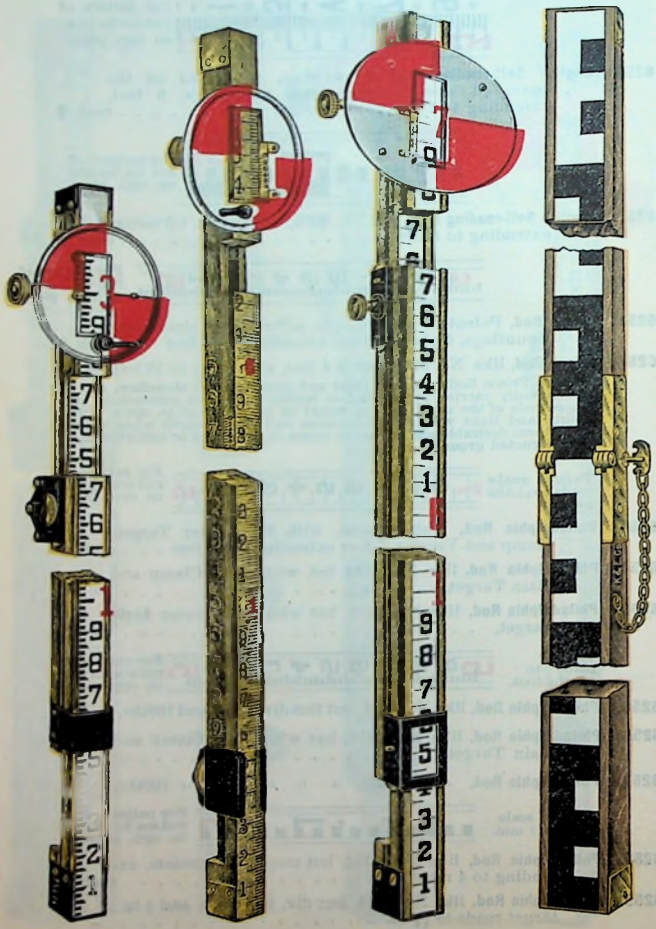
For pattern of rod see No. 6256 on opp. page.

6258. **Philadelphia Rod**, like No. 6254, but metric, 2.2 meters, extending to 4 meters . . . . . each $

6259. **Philadelphia Rod**, like No. 6254, but div. feet to in. and $\frac{1}{8}$ in.; target reads to $\frac{1}{16}$ in. . . . . "

For extra Targets, see page 395.
For Rod Levels and Canvas Covers for rods see page 405.

LEVELING AND STADIA RODS.



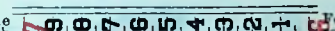
No. 6267½.
Mining.

6270.
New York.

6254C.
Plain Philadelphia.

6275.
Long Distance.

LEVELING RODS.



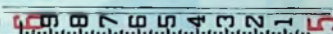
For pattern of rod see No. 6261 on page 396.

6260. **Light Philadelphia Rod,** white maple, with Micrometer Target, Clamp and Vernier, 6.5 feet, extending to 12 feet . . each $

6260C. **Light Philadelphia Rod,** like No. 6260, but with plain Clamp and plain Target, ... "

6261. **Light Philadelphia Rod,** like No. 6260, but with Micrometer Angle Target . . . . . "

6254C-6262C. For pattern of rod, see No. 6254C on page 398.



For pattern of rod see No. 6261 on page 396.

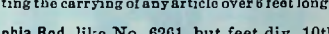
6262. **Light Philadelphia Rod,** like No. 6260, but feet div. 10ths and 100ths . . . . . each $

6262C. **Light Philadelphia Rod,** like No. 6262, but with plain Clamp and plain Target. . . . . "

6262S. **Light Philadelphia Rod,** like No. 6262, but 5.8 feet, extending to 10.6 feet . . . . . "

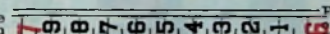
This rod is made 6 feet long over all, to comply with the law of a number of States prohibiting the carrying of any article over 6 feet long on trolley cars.

6263. **Light Philadelphia Rod,** like No. 6261, but feet div. 10ths and 100ths . . . . . each



For pattern of rod see No. 6261 on page 396.

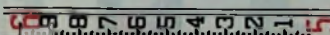
6264. **Light Philadelphia Rod,** like No. 6260, but metric, 2 meters, extending to 3.7 meters . . . . . each



For pattern of rod see No. 6267½ on opp. page.

6267. **Mining Rod,** white maple, with Micrometer Target, Clamp and Vernier, 3 feet, extending to 5 feet, target with slit . each

6268. **Mining Rod,** like No. 6267, but 5 feet, extending to 9 feet . . "



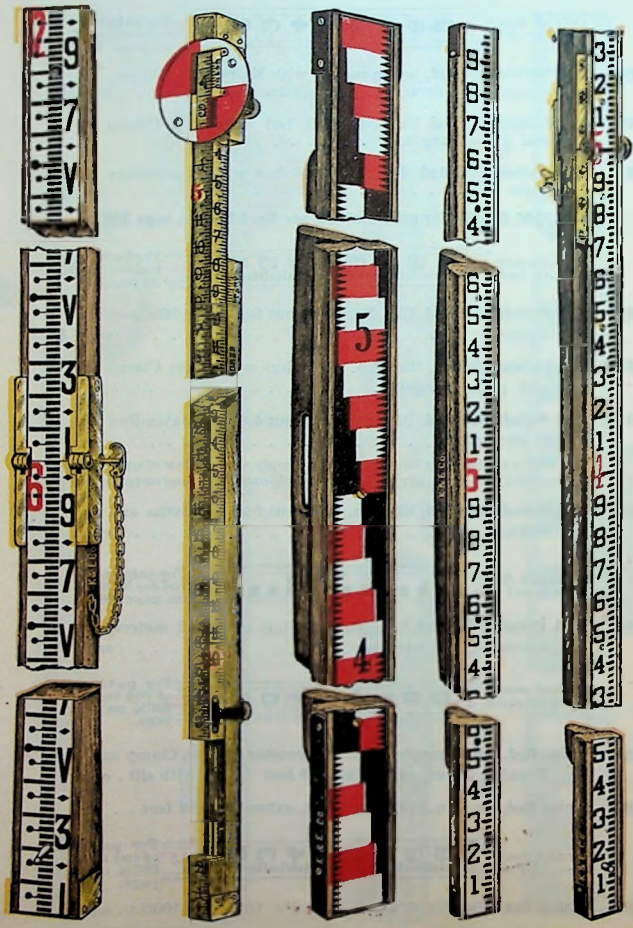
For pattern of rod see No. 6267½ on opp. page.

6267½. **Mining Rod,** like No. 6267, but feet div. 10ths and 100ths . each

6268½. **Mining Rod,** like No. 6268, but feet div. 10ths and 100ths . "

For extra **Targets**, see page 395.
For **Rod Levels** and **Canvas Covers** for rods, see page 405.

LEVELING RODS.



No. 6276. Telemeter.

6280. Architect's.

6284. Florida.

6286 A. Plain Stadia.

6287 A. Stadia, Folding.

LEVELING RODS.

Vernier reads to 1/100th foot.  For pattern of rod see No 6270 on page 398.

6270. **New York Rod,** white maple, engine divided, Micrometer Target, Clamp and Vernier, 6.5 feet extending to 12 feet . . . each $

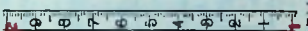
 For pattern of rod see No 6276 on opp. page.

6276. **Telemeter Rod,** pinewood, self-reading, folding, with strong, nickelplated bronze hinge, 12 ft., 2 fold, folding to 6 ft. each

6277. " " " " " " 14 " 2 " " " 7 " "

Vernier reads to 1/10th inch.  For pattern of rod see No 6280 on opp. page.

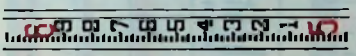
6280. **Architect's Rod,** white maple, brass mounted, with Target, Clamp and Vernier, engine divided, feet to inches and 1/8 in., 5½ feet, extending to 10 feet . . . . . each

Vernier reads to 1/100th foot  For pattern of rod see No. 6280 on opp. page.

6281. **Architect's Rod,** like No. 6280, but feet div. 10ths and 100ths each

 For pattern of rod see No. 6284. on opp. page.

6284. **Florida Rod,** pinewood (in one piece), stout tapering rib with opening for the hand, 10 feet . . . . . each

 For pattern of rod see No. 6286A. on opp. page.

6286A. **Plain Stadia Rod,** pinewood (in one piece), tapering rib, 10 feet . . . . . each

6286B. **Plain Stadia Rod,** like No. 6286A. but 12 feet . . . . . "

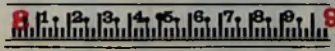
6286C. " " " " " " " 14 " . . . . . "

 For pattern of rod see No. 6287A. on opp. page.

6287A. **Plain Stadia Rod, Folding,** pinewood, strong brass hinge with brace, 10 feet, folding to 5 feet . . . . . each

6287B. **Plain Stadia Rod,** like No. 6287A. but 12 feet folding to 6 feet "

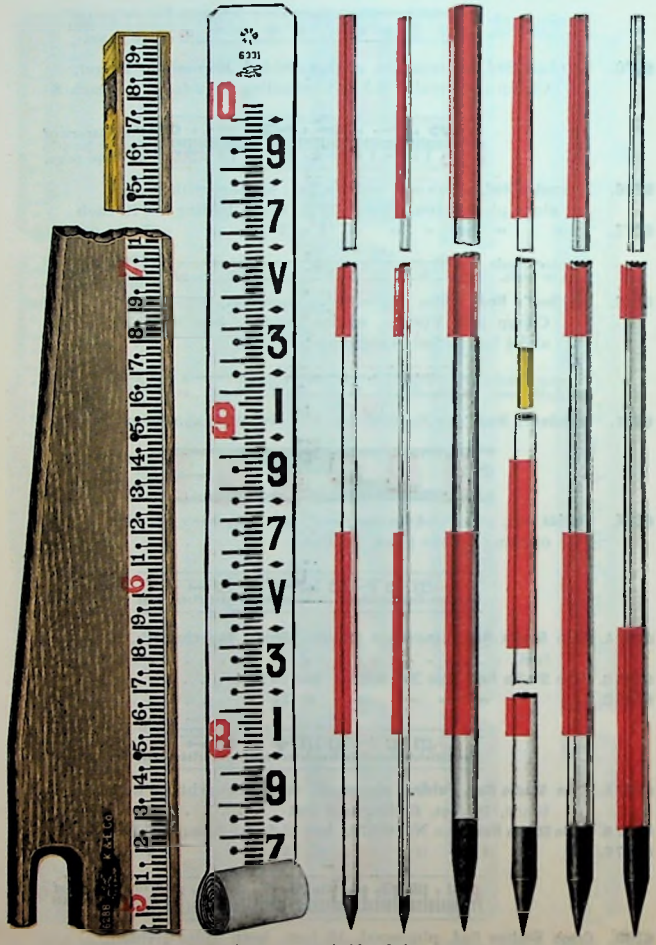
6287C. " " " " " " " 14 " " " 7 " "

 For pattern of rod see No. 6288 on page 402.

6288. **Cross Section Rod,** pinewood, 10 feet, both sides divided, spirit level at each end, opening for the hand . . . . each

For extra **Targets,** see page 395.
For **Rod Levels** and **Canvas Covers** for rods, see page 405.

LEVELING RODS AND RANGING POLES.



No. 6288.
Cross Section.

6331.
Flexible.

6290. 6291. 6292. 6292S. 6293. 6295.

FLEXIBLE OR POCKET LEVELING RODS.

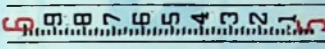


For pattern of rod see No. 6331 on opp. page.

6330. Flexible Rod, 3 in. wide, 8 feet, div. 10ths and 100ths feet, each $

6331. do. 3 " " 10 " " " " " " "

6332. do. 3 " " 12 " " " " " " "



For pattern of rod see No. 6331 on opp. page.

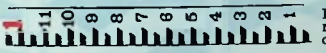
6333. Flexible Rod, 1½ in. wide, 10 feet, div. 10ths and 100ths feet, each $

6334. do. 1½ " " 12 " " " " " " "



For pattern of rod see No. 6331 on opp. page.

6335. Flexible Rod, 3 in. wide, 12 feet, feet div. inches and ⅛ in . each



For pattern of rod see No. 6331 on opp. page.

6335 S. Flexible Rod, 1½ in. wide, 6 feet, feet div. inches and ¼ in. . each



For pattern of rod see No. 6331 on opp. page.

6340. Flexible Rod, 3 in. wide, metric, 3.5 meters, div. to centimeters . . . . . each

These Rods are strips of prepared canvas, graduated like self-reading rods. For use they are fastened to a straight board with thumb tacks. When rolled up they are easily carried in the pocket. They are put up in neat boxes.

RANGING POLES.

See illustrations on opp. page.

METAL

6290. Iron Tubular Ranging Poles, round ⅞ in. diameter, painted red and white alternately every foot, 6 8 10 feet
each $

6291. Steel Ranging Poles, hexagonal (solid), ½ in. diameter, painted red and white alternately every foot, 6 8 feet
each $

WOOD (white pine) with hand forged shoes.

6292. Ranging Poles of best seasoned wood, **round**, painted red and white alternately every foot, 6 8 10 feet
each $

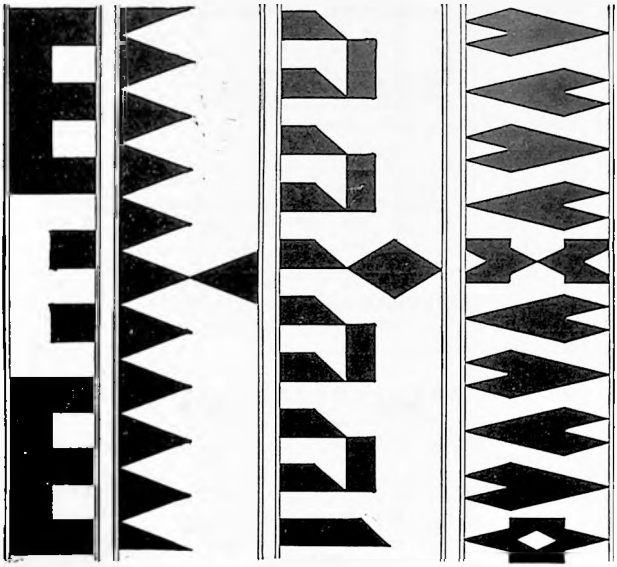
6292 S. Ranging Poles, **sectional**, reinforced, of best seasoned wood, tapered, in two sections, painted red and white alternately every foot, 8 10 feet
each $

6293. Ranging Poles of best seasoned wood, **octagonal**, tapered, painted red and white alternately every foot, 6 8 10 feet
each $

6295. Ranging Poles, **metric**, of best seasoned wood, octagonal, tapered, painted red and white alternately every half meter, 2 2½ 3 meters
each $

SELF-READING STADIA RODS

FOR LONG DISTANCE WORK.



We show here designs of several **Long Distance Stadia Rods** which we have made to order. On application we shall be pleased to give prices for making special rods.



For pattern of rod see No. 6275 on page 398.

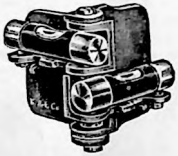
6275. **Long Distance Stadia Rod,** Pinewood, self-reading, with strong bronze hinge, 14 ft., 2 fold, folding to 7 ft., ... each $

ROD LEVELS.



No. 6299.

Illustration about ½ size.



6300.

6299. Rod Level, brass, circular spirit level . . . . . each $

6300. Rod Level, brass, folding, 2 spirit levels. . . . . "

Rod Levels are used for determining whether the rod is held perpendicular.

In No. 6299 the long angle plate insures proper contact if held to the rod; it may also be attached to the rod by means of a round-head screw for which there is a keyhole slot in the plate.

No. 6300 may be attached to the rod by means of a rubber band, for which purpose it is provided with two folding hooks.

CANVAS COVERS

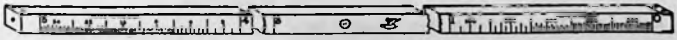
FOR RODS AND POLES.

6302. Canvas Covers for rods Nos. 6250 to 6264, 6270 and 6272. . . . . each $

6303. Canvas Covers for poles Nos. 6290 to 6295. . . . . "

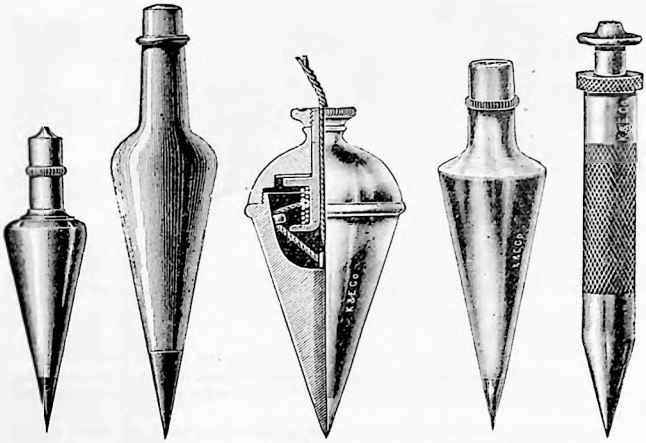
These covers are of heavy canvas, well made, to protect the rod or pole. In ordering these covers, please state for which catalogue number of rod or pole, and give length of pole.

STANDARD MEASURES.



We make to order Standard Measures of wood, iron, brass or nickel silver, graduated in U. S. or any foreign measure. Prices according to specifications.

PLUMB BOBS.



Nos. 6480 to 6482. | 6483 to 6485. | 6487. | 6489, 6490. | 6492, 6493.

6480. Fine Brass Plumb Bob, with hardened steel point, screw cap, about 6 oz. . . . . each $

6481. do. do. " 8 " . . . . . "

6482. do. do. " 12 " . . . . . "

6483. Fine Brass Plumb Bob, with hardened steel point, screw cap, long neck, about 14 oz. . . . "

6483-1. do. do. do. " 18 " . . . "

6484. do. do. do. " 24 " . . . "

6485. do. do. do. " 32 " . . . "

6487. Fine Brass Plumb Bob, with reel inside, on which the line is wound and held by friction at any point of its length, about 10 oz. . . . . "

6488. Plain Iron Plumb Bob, about 7 oz. . . . . "

6489. Plain Brass Plumb Bob, steel point, screw cap, about 8 oz. . . "

6490. do. do. " " " " 12 " . . "

6491. Sheaths for Plumb bobs, see next page.

STEEL AND MERCURY-FILLED PLUMB BOBS.

6492 B. Fine Solid Steel Plumb Bob, nickelplated, with screw cap, about 6 oz., 5 in. long, 1¼ in. diam., each. $

6493 B. Fine Steel Plumb Bob, nickelplated, with screw cap, loaded with mercury, about 8 oz., 5 in. long, 1¼ in. diam., each. $

Plumb Bobs Nos. 6492B and 6493B are made of steel rod. Their small diameter permits of their use close to walls or other surfaces and prevents their being readily swayed by the wind. The No. 6493B is hollow and filled with mercury, which makes it very heavy for its size, and brings the center of gravity nearer to the point of the bob.

SHEATHS FOR PLUMB BOBS.



No. 6491.

6491 A. Sewed Leather Sheath, with belt loop, for Plumb Bobs, 6 to 8 oz. . . . . each $

6491 B. do. 12 to 14 oz. . . . . "

6491 C. do. 18 to 24 oz. . . . . "

6491 D. do. 32 to 48 oz. . . . . "

PLUMB BOB CORD.

6496. Plumb Bob Cord, best linen, thin, medium or thick. . per yard $

6497. do. best braided silk . . . . . " "

STAKE TACKS.



No. 6494.

SPADS.



No. 6498.

6494. Stake Tacks, galvanized, tin box of 50 . . . . . $
6495. do. do. " " " 100 . . . . . .
6495B. do. do. " in bulk (5 lbs. or over). . . . per lb.

These tacks have an indentation in the surface of the head, so that the plumb bob, if suspended, exactly indicates location.

6498. Surveying Spads, Montgomery's, steel, 2¼ in., for suspending plumb bob from timbers in mines; tin box of 50. . . . .
6498M. do. do. do. in bulk, per lot of 1000. . . . .
6499. do. do. do. but 1¼ in. tin box of 50. . . . .
6499M. do. do. do. in bulk, per lot of 1000. . . . .

SURVEYOR'S LEATHER BAGS.



No. 7090.



7092.

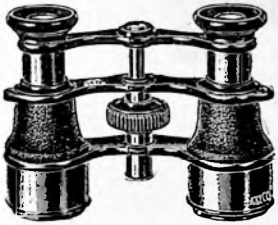
7090. Surveyor's Leather Bag . . . . . each $
7092. " " " . . . . . "

EXTRA-FINE

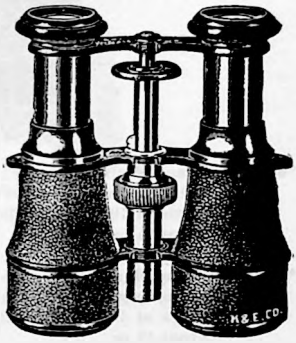
FIELD AND MARINE GLASSES.

The Field and Marine Glasses and Prism Binoculars here listed are of the finest quality and finish. They have been selected to meet the exacting requirements of the Engineer, Tourist, Sportsman and Naturalist, and may be depended upon to be of the highest optical efficiency and satisfactory in every respect.

All of these glasses can be adapted to the distance between the eyes of the observer, as the bars connecting the two bodies are hinged. A short graduated arc and index facilitate setting the interpupillary distance when this is once determined. The focusing is by means of a central thumbscrew.



No. 6923.



6929.

6923. Field and Marine Glass, Object Glass 1⅜ in., magnifying power 3½ diameters, field of view 115 yards at 1000 yards. Body finished in black lacquer and black grained leather. Weight about 15 oz. In stiff leather Sling Case, with shoulder strap and cord . . . . . each $

6927. Field and Marine Glass, Object Glass 2⅛ in., magnifying power 4 diameters, field of view 105 yards at 1000 yards. Body finished in black lacquer and black grained leather, sunshades leather covered. Weight about 30 oz. In stiff leather Sling Case, with shoulder strap and cord . . . . . "

***6929.** Field and Marine Glass, Object Glass 1¾ in., magnifying power 6 diameters, field of view 60 yards at 1000 yards. Body finished in black lacquer and black grained leather, sunshades leather covered, weight about 21 oz. In stiff leather Sling Case, with shoulder strap and cord, "

*See note on page 410.

EXTRA-FINE

FIELD AND MARINE GLASSES.



No. 6938.

***6933.** Field and Marine Glass, like No. 6929, but Object Glass $1\frac{3}{4}$ in., magnifying power 8 diameters, field of view 50 yards at 1000 yards. Body of aluminum. Weight about 14 oz. . . . . each $

***6934.** Field and Marine Glass, like No. 6929, but Object Glass $1\frac{1}{8}$ in., magnifying power 9 diameters, field of view 45 yards at 1000 yards. Body of aluminum. Weight about 15 oz. . . . . each $

*In the glasses Nos. 6929 to 6934, the focusing screw is independent of the telescoping arrangement, so that closing the glass and drawing out the tubes will not disturb the focus to which they have been adjusted by the focusing screw.

6936. Field and Marine Glass, Object Glass $1\frac{7}{8}$ in., two magnifying powers, $4\frac{1}{2}$ and $6\frac{1}{2}$ diameters, field of view 70 and 50 yards at 1000 yards. Body finished in black lacquer and black grained leather, sunshades leather covered. Weight about 24 oz. In stiff leather Sling Case with shoulder strap and cord . . . . . each $

The two powers of this glass are produced by a movable auxiliary lens in the eyepiece, which drops into the field or out of it according to the position in which the glass is held. The upper cross bar is marked to show which power is employed.

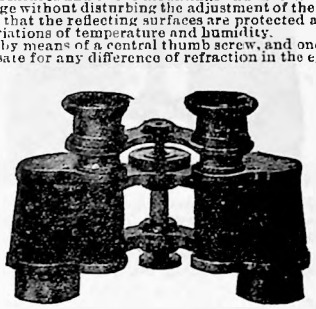
6938. Field Glass, Object Glass $1\frac{9}{16}$ in. (40 mm.) effective diameter, magnifying power 6 diameters. Field of view 80 yards at 1000 yards. Angular measure 4.5°. Body finished in black lacquer. Weight about 19 ozs. Stiff leather Sling Case with shoulder strap. . . . . each $

EXTRA-FINE

PRISM BINOCULARS.

These Prism Binoculars are of latest improved design, and of the finest quality in regard to their optical features and to the mountings and casings. They will withstand considerable rough usage without disturbing the adjustment of the prisms, and the casings are so accurately made that the reflecting surfaces are protected against dust and moisture under extreme variations of temperature and humidity.

They are focused by means of a central thumb screw, and one of the eyepieces can be adjusted to compensate for any difference of refraction in the eyes.



No. 6942.

6942. Prism Field Glass, Object Glass 1 in. (24mm.) effective diameter, magnifying power 6 diameters. Relative luminosity 16. Field of view 140 yards at 1000 yards. Angular measure 8.0°. Body finished in black lacquer and heavy grained leather. Weight about 19 ozs. Stiff leather Sling Case with shoulder strap. . . . . each $



No. 6943.

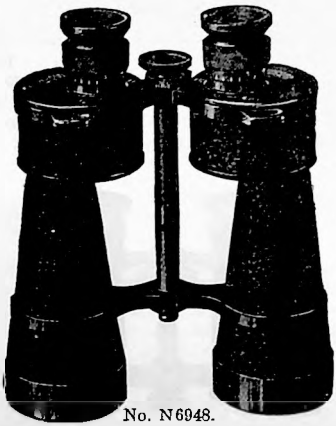
6943. Prism Field Glass, Object Glass $1\frac{3}{8}$ in. (30 mm.) effective diameter, magnifying power 6 diameters. Relative luminosity 25. Field of view 150 yards at 1000 yards. Angular measure 8.5°. Body finished in black lacquer and heavy grained leather. Weight about 26 ozs. Stiff leather Sling Case with shoulder strap. . . . . each $

PRISM BINOCULARS.



No. 6946.

6946. Prism Field Glass, Object Glass $1\frac{3}{4}$ in. effective (30 mm.) diameter, magnifying power 8 diameters. Relative luminosity 14. Field of view 115 yards at 1000 yards. Angular measure 6.5°. Body finished in black lacquer and heavy grained leather. Weight about 27 ozs. Stiff leather Sling Case with shoulder strap . . . . . each $



No. N6948.

***N6948.** Prism Field Glass, Object Glass $2\frac{3}{4}$ in. (60 mm.) effective diameter, magnifying power 12 diameters. Relative luminosity 25. Field of view 75 yards at 1000 yards. Angular measure 4.3°. Body finished in black lacquer and heavy grained leather. Weight about 60 ozs. Stiff leather Sling Case with shoulder strap . . . . . each $

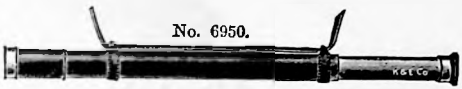
***NOTE.** On account of its high magnifying power, this glass should be firmly supported during observations. When holding it in the hand, the arm should rest upon some rigid object, to obtain the full benefit of the high power.

EXTRA-FINE
SPYGLASSES.



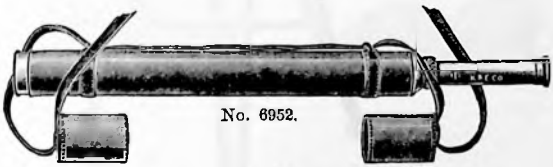
No. 6949.

6949. Spyglass, 1¼ inch achromatic Object Glass, magnifying power 12½ diameters, one draw tube; length closed about 17 in.; extended 21 in. Body enameled leather color . . . . . each $



No. 6950.

6950. Spyglass, U. S. Navy Pattern, 1¼ in. achromatic Object Glass, magnifying power 12½ diameters, one draw tube, length closed about 17 in.; extended 21 in. Body leather covered; leather caps and shoulder strap . . . . . each $



No. 6952.

6952. Spyglass, U. S. Navy Pattern, 1¼ in. achromatic Object Glass, magnifying power 13½ diameters, one draw tube with focusing device (knurled ring), length closed about 22 in.; extended 26 in. Body leather covered; leather caps and shoulder strap . . . . . each $

6953. Spyglass, U. S. Navy Pattern, like No. 6952, but with power of 20 diameters . . . . . "



No. 6954.

6954. Spyglass, U. S. Navy Pattern, 2⅛ in., achromatic Object Glass, magnifying power 30 diameters, one draw tube with focusing device (knurled ring). Length closed about 24 in.; extended 28 in. Body leather covered; leather caps and shoulder strap, ... each $



The Optical Department of our works has at its disposal a staff of scientific experts and skilled mechanics, and is equipped with the latest and best appliances and precision tools.

We are prepared to design and manufacture instruments similar in type to those listed in this catalogue, either with straight line or with prism telescope.

Our facilities enable us also to make repairs on such instruments in the very best manner.

MAGNIFYING GLASSES.



No. N 6970.

N6970. Reading Glasses, **Nickel-plated** Rim, Black Handle, **Best Quality.**

	1½	2	2½	3	3½	4	4½	5 in.
each $								

POCKET MAGNIFYING GLASSES

MOUNTED IN METAL.



No. 6980.

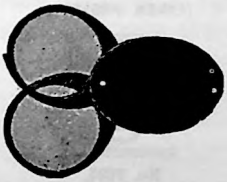


6986.

6980.	Round, bronzed frame,	1	lens,	1	in.	. . . . .	each $
6981.	do.	"	"	2	"	1 "	. . . . . "
6982.	do.	"	"	3	"	1 "	. . . . . "
6985.	do.	nickel silver frame,		1	lens,	1 in.	. . . . . "
6986.	do.	"	"	2	"	1 "	. . . . . "
6987.	do.	"	"	3	"	1 "	. . . . . "

These glasses have a large, flat field and good magnifying power; they are well adapted for reading graduations on Surveying Instruments. As they are mounted in metal they are more durable than those mounted in hard rubber. The mountings are non-magnetic.

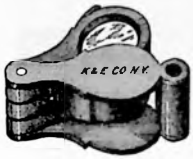
MOUNTED IN RUBBER.



No. 7002.

7000.	Oval Pattern,	1	lens,	1	in.	diameter	each $
7001.	do.	1	"	1½	"	"	"
7002.	do.	2	lenses,	1	"	"	"
7003.	do.	2	"	1½	"	"	"

ACHROMATIC POCKET MAGNIFIERS.



No. 7021.



7022.

7021. Pocket Magnifier, **achromatic**, nickelplated brass frame, lens $\frac{3}{4}$ in., magnifying power about 5 diameters, a very fine glass with good definition, for examining ore, etc.; each $

7022. do. do. do. but in brass cylinder Case "



No. 7023.



7024.



7026.

7023. Pocket Magnifier, extra powerful, **achromatic**, in bronzed brass frame, lens $\frac{1}{4}$ in., magnifying power about 12 diameters . . . . . each $

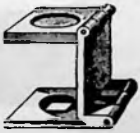
7024. Pocket Magnifier, **achromatic**, like No. 7023, but lens $\frac{3}{8}$ in. magnifying power about 5 diameters . . . . . "

7025. Coddington Lens, brass frame and handle, nickelplated, $\frac{3}{4}$ in., each $

7026. do. " " " " " $1\frac{1}{2}$ " "

THREAD COUNTERS.

(LINEN PROVERS.)



No. 7035.

7035. Thread Counter, folding brass frame, $\frac{1}{4}$ in. field . . . . each $

7036. do " " " $\frac{1}{2}$ " " . . . . "

7037. do " " " 1 " " . . . . "

KEUFFEL & ESSER CO. NEW YORK

K & E MEASURING TAPES.

Patented.

Manufactured by

KEUFFEL & ESSER CO.

These American-made tapes are recommended for their superiority in *design*, *material*, *workmanship*, and *accuracy*. They are graduated according to the U. S. Standard of the National Bureau of Standards at Washington, D. C.

Our Steel Tapes in feet are standard at 62° F; those in metric measure at 20°C.

KECO FINISH.

By this name we designate the superior finish which we put on all our steel tape lines. It produces a dense, even, black line surface with bright-steel graduations and figures of exceptional legibility. The KECO finish wears well, guards against rusting, tends to preserve the appearance of the line and obviates the necessity of greasing to protect it.

For description of "Ready Reading" Graduations, see page 418.

K & E STEEL TAPES WITH THERMOMETER SCALE.



Ending of 100 foot tape with Thermometer Scale. Actual size.

F. S. Patent Thermometer Scale on 50 or 100 foot tape, ... extra $

As a means of obtaining additional accuracy and uniformity in measuring, we recommend steel tapes with thermometer scale. This scale is graduated to correspond to the contraction and expansion of the tape, according to the Fahrenheit thermometer for tapes graduated in feet, or the Centigrade thermometer for tapes in metric measure. It takes the place of the terminal mark of the tape and the terminal point lies at that mark of the thermometer scale which corresponds to the prevailing temperature reading at the time of taking the measurement. For instance, when the temperature registers 80°, the terminal point will be at the graduation numbered 80 on the thermometer scale, at 20° it will be at the graduation numbered 20, etc., etc. The above cut, which is actual size, will show how important it is for exact measuring to make this correction for temperature, as the variation in 100 feet between 90° above and 20° below zero is about .07 feet. (The fig. "9" in the cut is the 9th tenth of the last foot of a 100 foot tape.)

This scale cannot be applied to Liliput, Midget, Dwarf, Handy, Home or Armor Tapes nor to tapes less than one-quarter inch wide, the latter exception including the Flat Wire Tapes and Band Chains listed on pages 441 to 452 inclusive.

For Pocket Thermometers, see page 378.

K & E STEEL TAPES WITH STATED TENSION.

T. E. Determining the tension and etching it on the line, for tapes up to 100 ft. . . . . extra $

To secure uniformity in measurements, we etch on any of our steel tapes (except Liliput, Midget, Dwarf, Handy, Home and Armor) the tension (in pounds, to the nearest halfpound) at which the tape is standard at 62° F. when supported for its entire length, and also when supported at its ends only.

For determining the tension of longer lines and etching on the line, prices will be according to conditions and will be quoted on application.

EXTRA-LONG TAPES.

We list our tapes in lengths up to 100 feet. If they are wanted of greater length, we make them to order in any of our styles with suitable cases or reels. For lengths beyond 100 feet, Flat Wire Tapes and Band Chains are generally preferred.

KEUFFEL & ESSER CO. NEW YORK

K & E

"READY READING" TAPES

Prevent Errors and Save Time.

The foot numbers, which are repeated at every sub number, are placed at right angles to the sub numbers and are read *across* the tape instead of lengthwise. This arrangement facilitates reading and thus prevents errors and saves time. In making horizontal measurements greater than five feet, the tape user is "behind" his tape, so that this lateral position of the foot numbers is the most natural and convenient, for both horizontal and vertical measuring, as shown in the cuts below. Furthermore, it is much less confusing than where all numbers (foot and inch or tenth alike) are positioned longitudinally on the tape; in which case, foot numbers and sub numbers, being often duplicated, are frequently mistaken for each other.

The foot number *is repeated at every inch mark or tenth mark*, directly ahead of the sub number, throughout the entire length of the tape. This absolutely prevents mistakes in reading the tape, since there can never be the slightest doubt as to the number of *feet* measured at any point on the tape.

The great advantages of this system of numbering are instantly obvious to any one who uses a tape, and will be fully appreciated because almost everyone has made mistakes of a foot in measuring with tapes numbered in the ordinary way, with the foot figures appearing only once every twelve inches. Such mistakes are always troublesome, frequently costly and sometimes dangerous.

Much time is also saved by this system of numbering, as one need not look back to the beginning of the foot to see the foot number; on the contrary, it is constantly in front of the eye in close juxtaposition to every sub number.





K & E Steel and Woven Tapes, Nos. 7152 to 7515 (except "New York") are now furnished with "Ready Reading" Graduations.



SUBDIVISIONS.

U. S. STANDARD.

Steel Tapes in 12ths have the foot graduated to inches ($\frac{1}{12}$ foot) and each inch to eighths, making the ultimate graduation $\frac{1}{8}$ inch, except the Liliput, Midget, Dwarf and Mechanic's Tapes, which are graduated to $\frac{1}{12}$ inch.

Steel Tapes in 10ths have the foot graduated into 10 parts and each $\frac{1}{10}$ again into 10 parts, making the ultimate graduation $\frac{1}{100}$ foot.

Woven Tapes in 12ths have the foot graduated to inches ($\frac{1}{12}$ foot) and the inches to halves, making the ultimate graduation half inch, except the Piccolo Tape, which is graduated to $\frac{1}{8}$ inch.

Woven Tapes in 10ths have the foot graduated into 10 parts and each $\frac{1}{10}$ into halves, making the ultimate graduation half tenths of a foot, except the Piccolo Tape, which is graduated to $\frac{1}{10}$ and $\frac{1}{100}$ foot.

Spring Winding Pocket Tapes: **Tip Top Tapes** are graduated to inches in 16ths, except Nos. 7713 TF, 7714 TF, 7714 TFM and 7723 TF, which are graduated to feet, inches and 16ths, and Nos 7711-4 and -8 which are graduated to inches and 16ths, other side to feet and $\frac{1}{8}$in. or $\frac{1}{8}$ in., respectively.

Spring Winding Pocket Tapes. **Tip Top Tapes** Nos. 7710 D to 7714 D, in 10ths have the foot graduated into 10 parts and each $\frac{1}{10}$ again into 10 parts, making the ultimate graduation $\frac{1}{100}$ foot.

Steel Tapes on which the measurement begins "on the line" have the zero mark $\frac{1}{10}$ or $\frac{1}{10}$ foot respectively from the end of the line.

METRIC.

Steel Tapes in **Metric** measure are graduated to half centimeters, the first decimeter to millimeters.

Woven Tapes in **Metric** measure are graduated to half centimeters throughout.

Spring Winding Pocket Tapes in **Metric** Measure are graduated to millimeters throughout

On all tapes in the METRIC measure except Paine's pattern tapes, the measurement begins "on the line."

OFFICIAL CERTIFICATE OF COMPARISON.

We can furnish a Certificate of Comparison by the National Bureau of Standards at Washington for any of the **K & E** Steel Tapes, the graduations of which **begin on the line.** The following prices for comparing include the Bureau's fee and the transportation charges to and from Washington.

Ca. For total length not greater than 100 feet or 50 meters either supported throughout or at intervals . . . . . $

Cb. For each additional 100 foot or 50 meter interval . . . . . .

Cc. For each additional 100 foot or 50 meter interval on the back of any tape compared . . . . . .

Cd. For comparing total length supported throughout and at intervals, for lengths of 100 feet or 50 meters . . . . . .

Ce. Same for each additional 100 feet or 50 meters. . . . . .

Cf. For each sub division compared . . . . . .

Cg. For determination of length at an additional tension, or with an additional number of points of support when being tested supported at intervals, for each 100 foot or 50 meter interval.

Ch. For determining the tension to the nearest 0.5 pound or 0.25 kilogram at which the tape is the most nearly correct at the standard temperature, there will be an additional charge for each 100 foot or 50 meter interval of . . . . . .

Ci. For determination of Young's modulus of elasticity for each 100 foot or 50 meter interval . . . . . .

Cj. For determining the weight of a tape per foot or per meter . .

OFFICIAL CERTIFICATE OF COMPARISON. (Cont'd.)

Ck. For testing spring balances accompanying tapes . . . . . $

Cl. For graduating tapes, each line, including the zero (this does not include the comparison of the lines) . . . . . .

Cm. For tapes not sent on a reel there will be an additional charge for each 100 foot or 50 meter length or fraction thereof, of . .

Cn. A discount of 20 per cent will be allowed on the above fees when tapes are submitted in lots of five or more.

Co. Comparison of a 50 meter tape on the geodetic comparator . . .

Cp. Comparison of two or more 50 meter tapes on the geodetic comparator, each . . . . . .

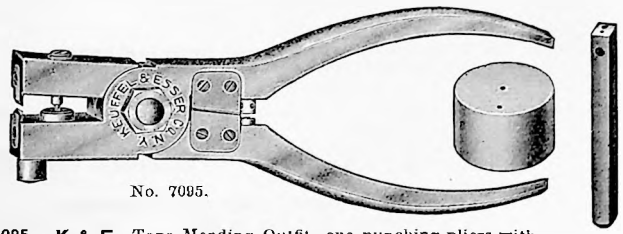
Cq. Comparison and determination of co-efficient of expansion of a 50 meter tape on the geodetic comparator . . . . . .

Cr. Comparison and determination of co-efficient of expansion of two or more 50 meter tapes on the geodetic comparator, each . .

Cs. Comparison of 50 meter tapes on the geodetic comparator at an additional tension or method of support . . . . . .

The certificate of the Bureau of Standards states, among other data, the temperature at which comparison was made, the method of support, the tension at which tape was compared, and the length corrected for the temperature of 62° F for tapes graduated into feet, or 20° centigrade for metric tapes.

TAPE MENDING OUTFIT.



No. 7095.

7095. **K & E** Tape Mending Outfit, one punching pliers with end nipper, shears and hammer, all combined in one tool. One extra punch for pliers. One rivet set, one small anvil. One box of rivet pins. One clamp, several pieces of ⅜ in. tape steel; in canvas bag, ... each $

TAPE MENDING TOOL.



No. 7098.

7098. Tape Mending Tool, combined cutter and riveter, 8 in., a light and convenient tool for quickly repairing tapes in the field. Tool, with 1000 eyelets (500 each of two sizes) . . . . . each $
Extra eyelets (500 in a package) . . . . . per mille

REPAIRING TAPES.

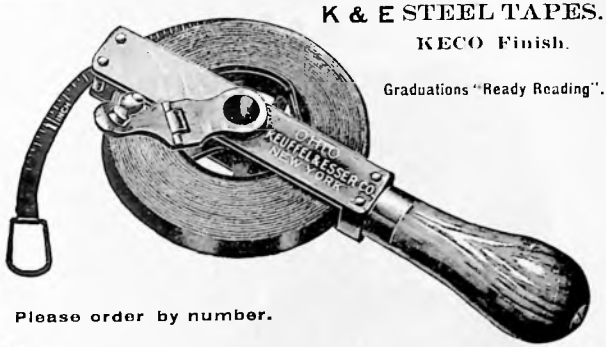
We promptly attend to any repairs on steel or woven tapes at a moderate charge.

KEUFFEL & ESSER CO. NEW YORK

K & E STEEL TAPES.

KECO Finish.

Graduations "Ready Reading".



Please order by number.

Ohio K & E Steel Tapes, 1/2 in. wide, on patent brass frame, large center with long folding handle, frame and all mountings nickelplated. Graduations begin on the line.

	Length in feet.	50	100
12ths of feet	No.	7152T	7155T
10ths " "		7152D	7155D
	each $		
	Length in Meters.	15	30
Metric (one side only)	No.	7152M	7155M
	each $		
Metric, other side 12ths of feet	No.	7152TM	7155TM
	each $		

Texas K & E Steel Tapes 3/8 in. wide, on patent brass frame, large center with long folding handle, frame and all mountings nickelplated. Graduations begin on the line.

Length in feet.	50	100	150*	200*
12ths of feet No.	7162T	7165T	7166T	7167T
10ths " "	7162D	7165D	7166D	7167D
each $				
Length in Meters.	15	30		
Metric (one side only) No.	7162M	7165M		
each $				
Metric, other side 12ths of feet No.	7162TM	7165TM		
each $				

*The reels of the 150 and 200 foot Texas Tapes are like those of the shorter lengths, but have crossarms (four-arm reels).

Maine K & E Steel Tapes, 5/16 in. wide, Paine's Pattern, on patent brass frame, large center with long folding handle, frame and all mountings nickelplated, two handles for tape line. Graduations begin at end of line.

Length in feet.	50	100
12ths of feet No.	7172T	7175T
10ths " " No.	7172D	7175D
each $		
Length in Meters.	15	30
Metric (one side only) No.	7172M	7175M
each $		
Metric, other side 12ths of feet No.	7172TM	7175TM
each $		

7185. Berkeley Tape, see page 423. For sequence of catalogue numbers, see Number Index.

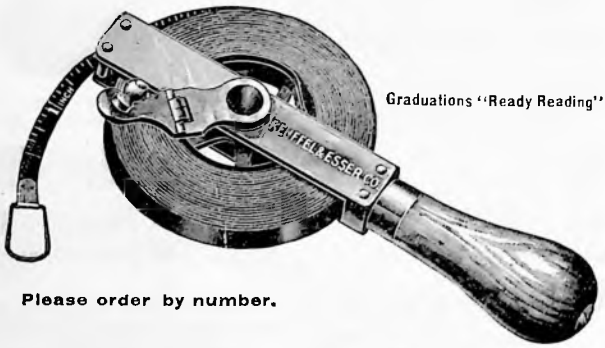
For Thermometer scale, see page 417.
Etching Tension on Line, see page 417.
Nickelplating Tape Lines, see page 423.

K & E

BRONZE TAPES.

(Special Bronze Alloy)

RUST PROOF.



Graduations "Ready Reading".

Please order by number.

K & E BRONZE TAPE 1/2 in. wide, on patent brass frame, large center with long folding handle, frame and all mountings nickelplated. Graduations begin on the line.

Length in feet,	50	100
12ths of feet.	No. 7387 T	7389 T
10ths of feet.	7387 D	7389 D
each $		

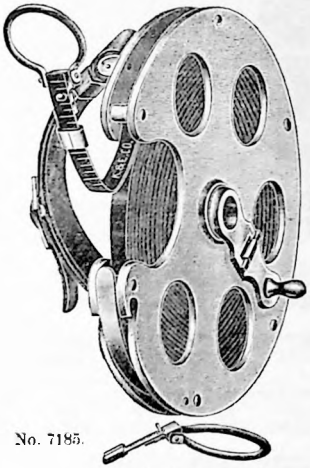
The Bronze Tapes are intended for use in salt or fresh water, mine waters, on board ship, etc. The lines are heavy bronze ribbon and the etched graduations are sharp and easily read.

Bronze Tapes in other measures or of other lengths, made to order.

For sequence of catalogue numbers, see Number Index.

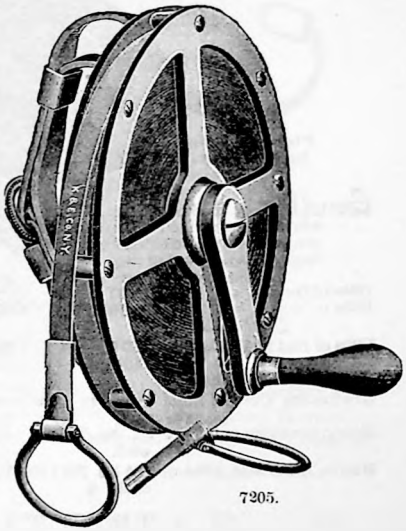
K & E STEEL TAPES.

KECO Finish.



No. 7185.

Graduations "Ready Reading"



7205.

Berkeley **K & E** Steel Tapes, 1/4 in. wide, Paine's Pattern, metal reel with leather strap handle, large center with long folding handle. Two handles for tape line. Reel aluminum, all mountings nickelplated. Graduations begin at end of line.

Please order by number.

Length in feet,	50	100	200	300
10ths of feet	No. 7182D	7185D	7187D	7188D
each $				
Length in Meters,	15	30		
Metric (one side only)	No. 7182M	7185M		
each $				

Purdue **K & E** Steel Tapes, 1/4 in. wide, Paine's Pattern, heavy brass reel with leather strap handle, large center with long crank and swiveling handle. Two handles for tape line. Reel and all mountings nickelplated. Graduations begin at end of line.

Length in feet,	100
10ths of feet	No. 7205D
each $	
Length in Meters,	30
Metric (one side only)	No. 7205M
each $	

The Purdue is an extra-heavy tape, which will stand rough usage.

For Thermometer Scale, see page 417.
Etching Tension on Line, see page 417.
Nickelplating Tape Lines, see page 433.

K & E STEEL TAPES.

KECO Finish.



Please order by number.

Graduations "Ready Reading".

Cornell **K & E** Steel Tapes, 3/8 in. wide, stout bent leather case, patent center, long swiveling flush folding handle, opened by pushing handle pin from opposite side of case. Nickelplated mountings. Graduations begin at outside end of ring.

Length in feet,	25	50	75	100
12ths of feet . . . . . No.	7250T	7252T	7254T	7255T
10ths " "	7250D	7252D	7254D	7255D
each $				
12ths of feet and links No.	7250TL	7252TL	7254TL	7255TL
10ths " " " "	7250DL	7252DL	7254DL	7255DL
each $				

Graduating Cornell Steel Tapes to 16ths inches throughout, add per foot $

Length in Meters.	10	15	20	25	30
Metric (one side only) . . . . No.	7251M	7252M	7253M	7254M	7255M
each $					
Metric, other side 12ths of feet No.	7251TM	7252TM	7253TM	7254TM	7255TM
each $					

TREE TAPE.

(FORESTER'S TAPE).



No. 7262DP.

7262DP. *Cornell* **K & E** Steel Tree Tape, 3/8 in. wide, 50 ft., one side 10ths and 100ths feet, other side, in the proportion of circumference to diameter, to feet, 10ths and 100ths, stout bent leather case, patent center, long swiveling flush folding handle, opened by pushing handle pin from opposite side of case. Nickelplated mountings. Jointed anchor peg for fastening to tree. Graduations begin at end of line, each $

As the two sides of this tape are graduated in the ratio of diameter to circumference (1:3.1416), either dimension can be read off opposite the other.

For other Circumference Tapes, see pages 429 and 454

For Thermometer Scale, see page 417.
Etching Tension on Line, see page 417.
Nickelplating Tape Lines, see page 433.

K & E STEEL TAPES.

KECO Finish.

Graduations "Ready Reading".



Please order by number.

Liliput **K & E** Steel Tapes, 1/4 in. wide, stout bent leather case, patent center, long swiveling flush folding handle, opened by pushing handle pin from opposite side of case. Nickelplated mountings. Graduations begin at outside end of ring.

Length in feet,	25	50	75	100
Dimensions,	2¼×⅛ in.	2¾×⅛ in.	3⅛×⅛ in.	3¾×⅛ in.
Weight,	3½ oz.	5 oz.	8½ oz.	10½ oz.
12ths of feet (inches in 10ths) No.	7270T	7272T	7274T	7275T
10ths " " (to 100ths feet)	7270D	7272D	7274D	7275D
each $				

Length in Meters,	10	15
Metric (one side only) . . . No.	7271M	7272M
each $		
Metric, other side 12ths of feet	7271TM	7272TM
each $		

The Liliput Steel Tapes are of the same grade, workmanship and accuracy as the Cornell **K & E** Steel Tapes but of smaller size. They are very compact and light and, therefore, suitable and convenient for the pocket.

Nickelplating Tape Lines, see page 433.

K & E STEEL TAPE.

KECO Finish.



Please order by number.

Graduations "Ready Reading".

Rensselaer **K & E** Steel Tapes, 5/16 in. wide, Paine's Pattern, stout bent leather case, patent center, long swiveling flush folding handle, opened by pushing handle pin from opposite side of case. Two handles for tape line. Nickelplated mountings. Graduations begin at end of line.

Length in feet,	50	75	100
12ths of feet	No. 7292 T	7294 T	7295 T
10ths " "	7292 D	7294 D	7295 D
each $			

Length in Meters,	15	20	25	30
Metric (one side only)	No. 7292 M	7293 M	7294 M	7295 M
each $				

The Rensselaer is an extra-fine stout heavy tape.

For Thermometer Scale, see page 417.
Etching Tension on Line, see page 417.
Nickelplating Tape Lines, see page 433.

K & E STEEL TAPES.

KECO Finish.

Graduations "Ready Reading".



Please order by number.

Illinois **K & E** Steel Tapes, 5/16 in. wide, Paine's Pattern, stout bent leather case, large center with long folding handle. Two handles for tape line. Nickelplated mountings. Graduations begin at end of line.

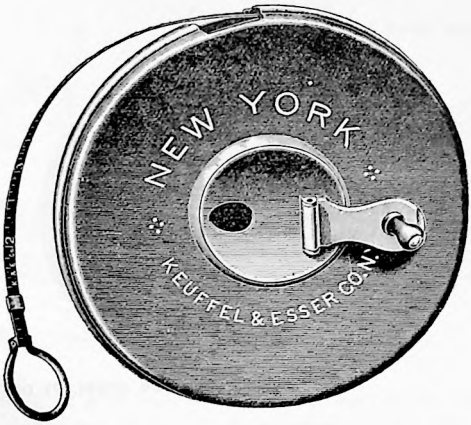
Length in feet,	50	75	100
12ths of feet	No. 7302T	7304T	7305T
10ths " "	7302D	7304D	7305D
each $			

Length in Meters,	15	20	25	30
Metric (one side only)	No. 7302M	7303M	7304M	7305M
each $				

For Thermometer Scale, see page 417.
Etching Tension on Line, see page 417.
Nickelplating Tape Lines, see page 433.

K & E STEEL TAPES.

KECO Finish.



Please order by number.

New York **K & E** Steel Tapes, 3/16 in. wide, Paine's Pattern, strong steel case, large center with long folding handle. Two handles for tape line. Case and mountings nickelplated. Graduations begin at end of line.

Length in feet,	50	100
10ths of feet.	No. 7322D	7325D
	each $	

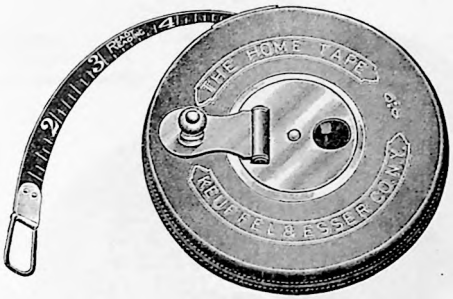
Length in Meters,	15	30
Metric (one side only) . . .	No. 7322M	7325M
	each $	

The New York Tape is an extra-narrow full divided tape, and is of heavy tough steel ribbon, so that it has good wearing qualities. It is intended especially for the use of Surveyors who require a strong tape which offers the least resistance to the wind

For Nickelplating Tape Lines, see page 433.

K & E STEEL TAPES.

KECO Finish.



Graduations "Ready Reading".

Self-Opening Handle.

HOME K & E Steel Tapes, 3/8 in. wide, stout bent leather case, large center, long folding "Self-opening" handle. Nickelplated mountings. Graduations begin at outside end of ring.

Please order by number.

Length in feet,	25	50	75	100
12ths of feet . . . . . No.	7350T	7352T	7354T	7355T
10ths " "	7350D	7352D	7354D	7355D
each $				

Length in Meters,	10	15	20	25	30
Metric (one side only) . . . No.	7351M	7352M	7353M	7354M	7355M
each $					
Metric, other side 12ths of feet No.	7351TM	7352TM	7353TM	7354TM	7355TM
each $					

HOME K & E Steel Tapes, 1/2 inch wide, stout bent leather case, large center, long folding handle. Nickelplated mountings. Graduations begin at outside end of ring.

Please order by number.

Length in feet,	25	50	75	100
12ths of feet . . . . . No.	7340T	7342T	7344T	7345T
10ths " "	7340D	7342D	7344D	7345D
each $				

Length in Meters,	10	15	20	25	30
Metric (one side only) . . . No.	7341M	7342M	7343M	7344M	7345M
each $					
Metric, other side 12ths of feet No.	7341TM	7342TM	7343TM	7344TM	7345TM
each $					

7358. **HOME K & E STEEL CIRCUMFERENCE** Tape, 3/8 in. wide, 50 feet, one side feet, inches and 8ths, other side in the proportion of circumference to diameter, in feet, stout bent leather case, ... each $

For other Circumference Tapes see pages 424 and 454

K & E STEEL TAPES.

KECO Finish.

Graduations "Ready Reading".



Self-Opening Handle.

HANDY K & E Steel Tapes, 3/8 inch wide, black sewed "Leatherite" case plain center with long folding, "self-opening" handle. Graduations "Ready Reading". Nickelplated mountings. Graduations begin at outside end of ring.

Please order by number.

Length in feet.	25	50	75	100
12ths of feet . . . . . No.	7383	7384	7385	7386
each $				

The Handy **K & E** Steel Tapes are intended to supersede the woven tapes which on account of their low price are often used where a more reliable tape ought to be employed. They are of high quality steel and accurately graduated. The neat sewed leatherite case of the Handy Tape is convenient to use and to carry in the pocket.

For Nickelplating Tape Lines, see page 433.

For sequence of catalogue numbers, see Number Index.

K & E STEEL TAPES.

KECO Finish.

Graduations
"Ready Reading".
Self Opening Handle.



ARMOR K & E Steel Tapes, 3/8 in. wide, strong steel case, large center with long folding handle. Case and mountings nickelplated. Graduations begin at outside end of ring.

Please order by number.

Length in feet.	25	50	75	100
12ths of feet . . . . . No.	7370T	7372T	7374T	7375T
10ths " "	7370D	7372D	7374D	7375D
each $				

Length in Meters.	10	15	20	25	30
Metric (one side only). . . . No.	7371M	7372M	7373M	7374M	7375M
each $					
Metric, other side 12ths of feet No.	7371TM	7372TM	7373TM	7374TM	7375TM
each $					

The strong pressed steel case of the Armor Tape, which is unaffected by oil or grit, adapts this Tape particularly well to Mechanics' use.

For Nickelplating Tape Lines, see page 433.

KEUFFEL & ESSER CO., NEW YORK

K & E STEEL TAPES.

KECO Finish.

Please order by number.



Graduations "Ready Reading".

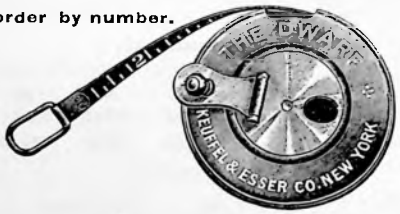
Self-Opening Handle.

MIDGET K & E Steel Tapes, 1/4 in. wide, stout bent leather case, long folding "Self-opening" handle. Nickelplated mountings. Graduations begin at outside end of ring.

Length in feet.	25	50	75	100
Dimensions	$2\frac{3}{8} \times \frac{3}{4}$ in.	$2\frac{7}{8} \times \frac{3}{4}$ in.	$3\frac{1}{4} \times \frac{3}{4}$ in.	$3\frac{7}{8} \times \frac{3}{4}$ in.
Weight (about)	$4\frac{1}{4}$ oz.	$6\frac{1}{2}$ oz.	$8\frac{1}{2}$ oz.	$10\frac{1}{2}$ oz.
12ths of feet (inches in 16ths) .	No. 7360T	7362T	7364T	7365T
10ths " " (to 100ths feet) .	7360D	7362D	7364D	7365D
each $				

The Midget Steel Tape meets the increasing demand for an accurate and durable steel tape of convenient size for the pocket, at a low price. It is similar to the Liliput tape but has a plain center, like the Home Tape.

Please order by number.



Graduations "Ready Reading".

Self-Opening Handle.

DWARF K & E Steel Tapes, 1/4 in. wide, strong steel case, long folding "Self-opening" handle. Case and Mountings nickelplated. Graduations begin at outside end of ring.

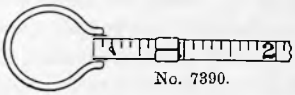
Length in feet,	25	50
Dimensions	$2\frac{1}{4} \times \frac{1}{4}$ in.	$2\frac{3}{4} \times \frac{1}{4}$ in.
Weight (about)	$3\frac{1}{2}$ oz.	6 oz.
12ths of feet. (inches in 16ths)	No. 7330T	7382T
10ths " " (to 100ths feet)	7380D	7382D
each $		

The Dwarf Steel Tape is an accurate and durable tape. The case is of steel and will stand much wear and rough usage. It is similar to the Armor tape but of pocket size.

7262 D P and 7358. Tree Tapes, see pages 424 and 429.
For Nickelplating Tape Lines, see page 433.

HANDLES FOR TAPES.

For Paine's Pattern Tapes.



No. 7390.

7390. Plain Brass Handles, Nickelplated. . . . . each $

7392. do. do. but large oval ring. . . . . "

TENSION AND CLAMPING HANDLES.

For Engineer's Steel Tapes.

These tension handles form a very valuable addition to a tape, as they enable the user to apply exactly the tension at which the tape is standard. They are recommended, also, for use with the fine narrow tapes.

No. 7401.



7402.

7401. Clamping Handles, brass, nickelplated, for narrow tapes, to attach to any part of tape . . . . . each $

7402. Tension Handles, brass, nickelplated, indicating tension up to 20 lbs., reading by half pounds . . . . . "

7403. do. do. like No. 7402, but indicating tension up to 30 lbs. . . . . "

NICKELPLATING STEEL TAPE LINES.

We are prepared to furnish our steel tape lines nickelplated in the best and most durable manner (for protection against rust) at the following extra charge:

Length in feet,	25	50	75	100
extra each $				

WOVEN TAPES.

Woven tapes of any make, are liable to stretch or shrink. Woven tapes should, therefore, not be used when exact measurements are required, without constant attention to their condition by comparison with a standard steel tape. Any of the **K & E** Steel Tapes will answer this purpose, as they are made according to the U. S. Standard of the National Bureau of Standards at Washington.

EXCELSIOR MEASURING TAPES.

WARD'S PATENT ENGINEER'S TAPE.



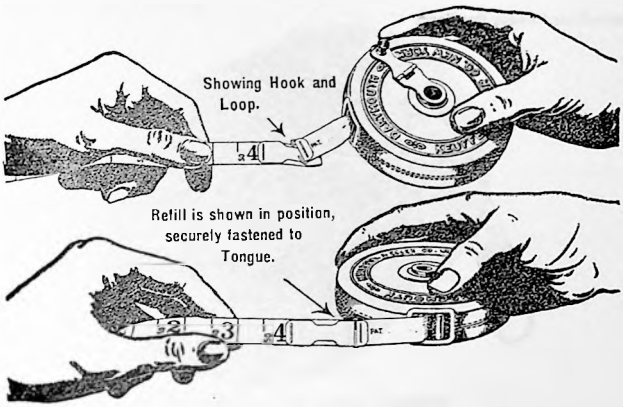
7410. Excelsior Engineer's Tapes, Ward's Patent, 50 feet, of same quality as No. 7442 (page 437) in bent leather case, long folding handle. Graduations begin at **outside end of ring.** All mountings nickelplated, graduated for single-track roadbed, with Directions, each . $

7411. Excelsior Engineer's Tapes, like No. 7410, but graduated for double-track roadbed . . . . . "

This is a woven tape in best bent leather case. One side of the tape is marked in feet and tenths, as for ordinary measurements, while the other side is marked in a special manner for setting Slope Stakes, or for finding the center from the Slope Stakes after the Center Stake has been removed.

A pamphlet, **How to Set Slope Stakes**, giving full particulars of the method of using them, is supplied with each one of these Tapes.

NEW METHOD OF INSERTING RE-FILLS IN TAPE CASES.



The latest step in the evolution of woven tape lines is illustrated above. One good tape case will usually outlast a number of woven tape lines. The old way of inserting a new tape line in the case was always more or less cumbersome, as it was necessary to open the metal center of the case, remove the end of the old line, insert the re-fill through the mouth of the case, and then — this was the most annoying part of the task — try to make the loop at the end of the re-fill slip over the binding post of the metal center.

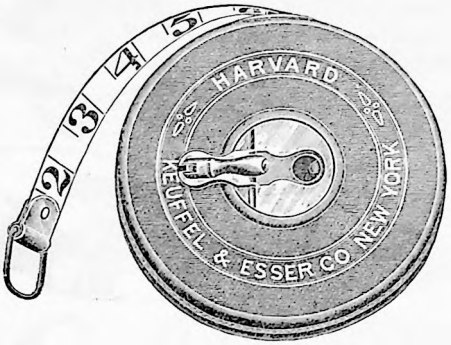
In working out the problem of improving upon the old method, we realized that the means to be adopted would have to be applicable not only to new tape cases, still to be constructed, but also to the thousands of our tape cases already in use.

In the patented device illustrated herewith, we offer a most successful solution of this problem. A short strip (or tongue) of woven tape line is attached by a loop to the binding post of the tape case. The other end of the tongue has a special form of hook over which is slipped the specially constructed loop in the end of the re-fill, in the manner shown in the illustration.

Our Harvard, Dartmouth, Piccolo and Samson Tapes are now furnished with this new patented tongue, and re-fills for the above tapes have the new type of loop. These re-fills will also fit old-style cases which do not have the new tongue.

K & E WOVEN TAPES.

Graduations "Ready Reading".



Please order by number.

Harvard **K & E** Woven Tapes, 5/8 in. wide, stout bent leather case, patent center, long flush folding handle, opened by pushing handle pin from opposite side of case. All mountings nickelplated. Leather reinforced end. Graduations begin at outside end of ring. **For patent Refilling Device see page 435.**

Length in feet,		25	50	75	100
12ths of feet	No.	7420T	7422T	7424T	7425T
10ths " "		7420D	7422D	7424D	7425D
each $					
12ths of feet and Links,	No.	7420TL	7422TL	7424TL	7425TL
10ths " " " "		7420DL	7422DL	7424DL	7425DL
each $					

Length in Meters.		10	15	20	25	30
Metric (one side only)	No.	7421M	7422M	7423M	7424M	7425M
each $						
Metric, other side 12ths of feet		7421TM	7422TM	7423TM	7424TM	7426TM
each $						

For lines without case (Re-fills), see page 438.

K & E WOVEN TAPES.

Graduations "Ready Reading".



Please order by number.

Dartmouth **K & E** Woven Tapes, 5/8 in. wide, stout bent leather case, long folding handle. All mountings nickelplated. Leather reinforced end. Graduations begin at outside end of ring. **For patented Refilling Device, see page 435.**

Length in feet.		25	50	75	100
12ths of feet	No.	7440T	7442T	7444T	7445T
10ths " "		7440D	7442D	7444D	7445D
each $					
12ths of feet and Links, ...	No.	7440TL	7442TL	7444TL	7445TL
10ths " " " "		7440DL	7442DL	7444DL	7445DL
each $					

Length in Meters.		10	15	20	25	30
Metric (one side only)	No.	7441M	7442M	7443M	7444M	7445M
each $						
Metric, other side 12ths of feet .	No.	7441TM	7442TM	7443TM	7444TM	7445TM
each $						

For Lines without cases (Re-fills), see next page.

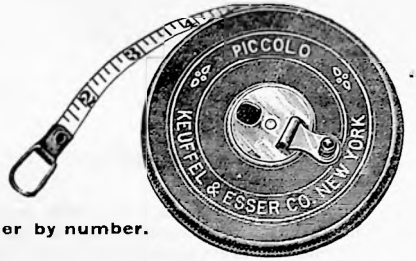
KEUFFEL & ESSER CO. NEW YORK

K & E WOVEN TAPES (RE-FILLS.)

Please order by number.

Length in feet.	25	50	75	100
12ths of feet	No. 7460T	7462T	7464T	7465T
10ths " " "	7460D	7462D	7464D	7465D
each $				
12ths of feet and Links, ...	No. 7460TL	7462TL	7464TL	7465TL
10ths " " " "	No. 7460DL	7462DL	7464DL	7465DL
each $				

Length in Meters.	10	15	20	25	30
Metric (one side only). . .	No. 7461M	7462M	7463M	7464M	7465M
each $					
12ths of feet and Metric, . .	No. 7461TM	7462TM	7463TM	7464TM	7465TM
each $					



Graduations "Ready Reading".

Self-Opening Handle.

Please order by number.

Piccolo **K & E** Woven Tapes, 3/8 in. wide, stout bent leather case, large center, long folding handle, all mountings nickelplated, line reinforced with leather. Graduations begin at outside end of ring. **For patented Re-filling Device, see page 435.**

Length in feet,	25	50
Size and Weight,	$2\frac{3}{4} \times \frac{3}{8}$ in., $4\frac{1}{4}$ oz.	$3\frac{5}{8} \times \frac{3}{8}$ in., $8\frac{1}{2}$ oz.
12ths of feet (inches in eighths)	No. 7480T	7482T
10ths " " (to 100ths feet)	7480D	7482D
each $		

Length in Meters,	10	15
Metric (one side only).	No. 7481M	7482M
each $		

Piccolo Woven Tapes are warranted to be of the same grade and workmanship as the Dartmouth **K & E** Woven Tapes. They differ from the Dartmouth only in size and weight, being very compact and light and, therefore, suitable and convenient for the pocket. This is a strong tape and will wear well.

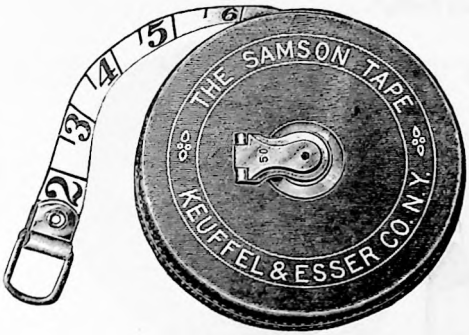
TAPE FOR MEASURING THE BASE LINE.

7482Y. K & E Woven Tape, length 20 yards, graduated to read 1000 yards by single yards . . . . . each $

This is a **K & E** Woven Tape, 3/8 in. wide, stout bent leather case, large center folding handle, all mountings nickelplated, end reinforced with leather. The line is 20 yards long and graduated on a scale of 1:50 to read direct up to 1000 yards by single yards.

The tape in its case measures about 3-5/8x5/8 in. and weighs about 9 oz. Its compactness and light weight make it convenient for carrying in the pocket.

K & E WOVEN TAPES.



Graduations "Ready Reading"

Please order by number.

Samson **K & E** Woven Tapes, 5/8 in. wide, stout bent leather case, long folding handle. All mountings nickelplated. **Extra-heavy** line, reinforced end. Graduations begin at outside end of ring. **For Patented Re-filling Device, see page 435.**

Length in feet.	25	50	75	100
12ths of feet . . . . . No.	7490T	7492T	7494T	7495T
10ths " "	7490D	7492D	7494D	7495D
each $				

The Samson is a woven line which surpasses all others in durability, and is made especially to withstand the severe conditions of railroad construction, lumbering, dock building, mining, etc. The tape will prove highly efficient where steel tapes and other woven lines do not give satisfaction owing to their being affected by dampness. The line is very closely woven and has a coating which protects it from moisture.

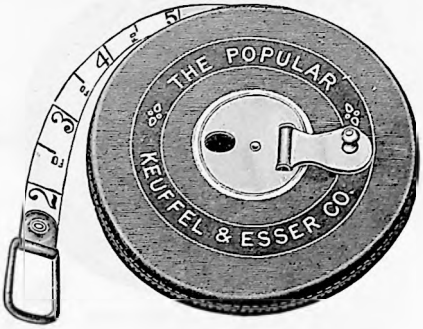
LINES WITHOUT CASES FOR SAMSON TAPES.

(RE-FILLS.)

Length in feet.	25	50	75	100
12ths of feet . . . . . No.	7500T	7502T	7504T	7505T
10ths " "	7500D	7502D	7504D	7505D
each $				

THE POPULAR WOVEN TAPES.

Graduations "Ready Reading".



Please order by number.

THE POPULAR Woven Tapes, 5/8 in. wide, substantial bent leather case, flat folding handle. All mountings nickelplated. Stout woven line, end reinforced with leather. Graduations begin at **outside end of ring.**

Length in feet.	25	50	75	100
12ths of feet	No. 7510T	7512T	7514T	7515T
10ths " "	7510D	7512D	7514D	7515D
each $				

Length in Meters.	15	25	30
Metric (one side only)	No. 7512M	7514M	7515M
each $			

The POPULAR is a low-priced, well-made woven tape in stout bent leather case, with durable center and handle. The line is of the usual width and finish of our woven tapes, heavily coated, and has leather reinforced end.

K & E
FINE FLAT STEEL WIRE TAPES.

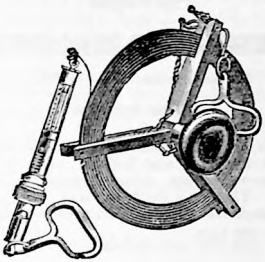
FOR

CITY, MINE, BRIDGE AND RAILROAD ENGINEERING.

KECO Finish.

CITY ENGINEER'S STANDARD TAPE.

(Not Subdivided.)



No. 7600.

7600. City Engineer's Standard Tape, $\frac{1}{2}$ in. wide, 50 ft., with improved spring balance adjustable for temperature, with level and thermometer, two nickelplated handles on folding brass reel No. 7650 B . . . . . each $

7601. City Engineer's Standard Tape, like No. 7600, but 100 ft. . "

7605. do. do. do. like No. 7600, but 25 meters "

The spring balance consists of two telescoping brass tubes connected by a strong spring; the inner tube carries the spirit level and tension mark, and the outer one carries the thermometer which is protected by a revolving semi-tubular cover. A knurled clamping ring encircles the outer tube; in it is cut a V-shape groove representing the END MARK of the measure. The spring balance up to the groove in the ring is INCLUDED IN THE MEASURE. On the outer tube is engraved the temperature scale, which compensates expansion and contraction and is marked with the corresponding degrees Fahrenheit. Correction for temperature, *i. e.* allowance for contraction and expansion is made by adjusting the clamping ring on the temperature scale to the degree indicated by the thermometer. The starting point is marked by another V-shape groove in a brass plate at the other end of the tape. There are no intermediate graduations on this tape, and the tension and temperature corrections apply to its entire length only.

DIRECTIONS.

To use this tape, adjust the clamping ring according to the temperature as read on the thermometer, then bring the V-shape zero groove in the brass lug at the other end of the line exactly over the starting point by means of a suspended plumbbob; pull the telescoping handle until the tension marks coincide, and bring the tape into a horizontal plane by means of the spirit level. A second plumbbob suspended from the V-shape groove on the spring balance will then indicate the terminal point on the ground.

K & E FLAT WIRE TAPES, GRADUATED.

These tapes are made of the best and toughest flexible steel ribbon, carefully tempered to prevent breaking or kinking. They are graduated according to the standard of the National Bureau of Standards and are correct at 68° Fahrenheit.

For certificate of temperature and tension, see pages 419 and 420.

FLAT WIRE TAPES WITH ETCHED GRADUATIONS.

KECO FINISH.



Etched graduations, (No. 7607).

Graduated to feet only.

7607. Flat Wire Tapes, KECO finish, $\frac{1}{4}$ in. wide, graduated at every foot, endfeet to 10ths and 100ths. The graduations are **etched** in a new manner, which insures their durability in rough work. They can be furnished in any length up to 500 feet; 2 detachable nickelplated brass handles. 100 feet . $

Each additional 100 feet. . . . . .



Etched graduations, (No. 7608).

Graduated, feet to 100ths throughout:

7608. Flat Wire Tapes, KECO finish, $\frac{1}{4}$ in. wide, **etched** to 10ths and 100ths ft., black line, bright numbers and graduations. They can be furnished in any length up to 500 feet. 2 detachable nickelplated brass handles, 100 feet . . . . . $

Each additional 100 ft., same graduation. . . . . .

7609. Flat Wire Tapes, like No. 7608, but nickelplated . . . . . .

Each additional 100 ft., same graduation. . . . . .

Above tapes with one extra subdivided foot BEFORE zero, furnished to order without extra charge.

Reels are listed separately (see page 445 etc.) and are not included in the price of these tapes.

Fine flat wire tapes graduated in Links, Varas, or other measures, furnished to order at short notice.

FLAT WIRE TAPES, GRADUATED ON CLAMPED SLEEVES.



Graduations on clamped sleeves, (No. 7610).

Our Fine Flat Wire Steel Tapes with brass sleeves are of the most improved type. The sleeves are firmly clamped (or clamped and soldered) and are notched directly opposite the graduation, for the exact locating of the plumb-bob line. The ends of the sleeves are beveled to prevent their catching on obstructions when measuring, or on each other when winding or unwinding the tape.

These Tapes can be made in any length up to 1000 feet, without joints.

7610. Flat Wire Tapes, KECO finish, ⅜ in. wide, black line, graduated on clamped brass sleeves, 2 detachable nickelplated brass handles, graduated every foot, end feet to 10ths, 100 feet. . $

Each additional 100 ft., same graduation . . . . . .

7610D. Flat Wire Tapes like No. 7610, but graduated every 5 feet, first and last five feet every foot, end feet to 10ths, 100 feet.
Each additional 100 feet, same graduation. . . . . .

7610F. Flat Wire Tapes like No. 7610, but graduated every 10 feet, first and last five feet every foot, end feet to 10ths, 100 feet.
Each additional 100 feet, same graduation. . . . . .

7610W. White plating, to resist rust, per 100 feet . . . . . .

Above tapes with one extra subdivided foot BEFORE zero, furnished to order without extra charge.

FLAT WIRE TAPES, METRIC; CLAMPED SLEEVES.



Graduations on clamped sleeves, (No. 7612).

7612. Flat Wire Tapes, (Metric) KECO finish, ⅜ in. wide, graduated on clamped brass sleeves, 2 detachable nickelplated brass handles, graduated every 20 cm., end meters to decimeters, 25 meters, $
Each additional 25 meters . . . . . .

7612C. Flat Wire Tapes like No. 7612, but graduated every half meter, end meters to decimeters, 25 meters . . . . . .
Each additional 25 meters . . . . . .

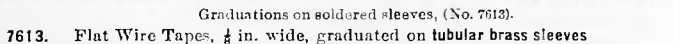
7612E. Flat Wire Tapes like No. 7612, but graduated every meter, end meters to decimeters, 25 meters . . . . . .
Each additional 25 meters . . . . . .

7612W. White plating, to resist rust, per 25 meters. . . . . .

Reels are listed separately (see page 445 etc.) and are not included in the price of these tapes.

Fine flat wire tapes graduated in Links, Varas, or other measures, furnished to order at short notice.

FLAT WIRE TAPES GRADUATED ON SOLDERED SLEEVES.



Graduations on soldered sleeves, (No. 7613).

7613. Flat Wire Tapes, $\frac{1}{4}$ in. wide, graduated on **tubular brass sleeves carefully soldered** to the tape, to prevent corrosion from moisture entering between sleeves and tape line, **heavily plated with white metal** (to resist rust), 2 detachable nickelplated brass handles, graduated every foot, end feet to 10ths., 100 feet . $

Each additional 100 ft., same graduation . . . . . .

7613D. Flat Wire Tapes like No. 7613, but graduated every 5 feet, first and last five feet every foot, end feet to 10ths, 100 feet. . .

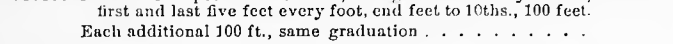
Each additional 100 ft., same graduation . . . . . .

7613F. Flat Wire Tapes like No. 7613, but graduated every 10 feet, first and last five feet every foot, end feet to 10ths., 100 feet.

Each additional 100 ft., same graduation . . . . . .

Above tapes with one extra subdivided foot BEFORE zero, furnished to order without extra charge.

FLAT WIRE TAPES, METRIC, SOLDERED SLEEVES.



Graduations on soldered sleeves, (No. 7614).

7614. Flat Wire Tapes, (Metric) $\frac{1}{4}$ in. wide, graduated on **tubular brass sleeves carefully soldered** to the tape to prevent corrosion from moisture entering between sleeves and tape, **heavily plated with white metal** (to resist rust), 2 detachable nickelplated brass handles, graduated every 20 centimeters, end meters to decimeters, 25 meters. . . . . $

Each additional 25 meters . . . . . .

7614C. Flat Wire Tapes like No. 7614, but graduated every half meter, end meters to decimeters, 25 meters. . . . . .

Each additional 25 meters . . . . . .

7614E. Flat Wire Tapes like No. 7614, but graduated every meter, end meters to decimeters, 25 meters . . . . . .

Each additional 25 meters . . . . . .

NOTE. Etched tapes (or tapes with etched end units) can be furnished nickelplated, but they cannot be furnished plated with white metal. Tapes plated with white metal cannot be furnished with end units etched.

Reels are listed separately (see page 445 etc.) and are not included in the price of these tapes.



For Clamping Handle to attach at any part of tape line, and for Tension Handles, see page 433.

Fine flat wire tapes graduated in Links, Varas, or other measures, furnished to order at short notice.

REELS FOR FLAT WIRE TAPES.

The reels here described embody all the latest improvements, the result of years of experience and study.

Any of the Steel Tapes listed under Nos. 7607 to 7614 can be furnished on the Reels here listed, with such limitations as to length as are stated in the descriptions of the reels The prices of Flat Wire Tapes are for the tape lines only: the price of the reel is extra.



7650 A.



7650 A folded.

7650A. Folding Reel, hardwood, plain, nickelplated brass trimmings, for tapes 100 to 500 ft. long . . . . . each $



No. 7650 B.



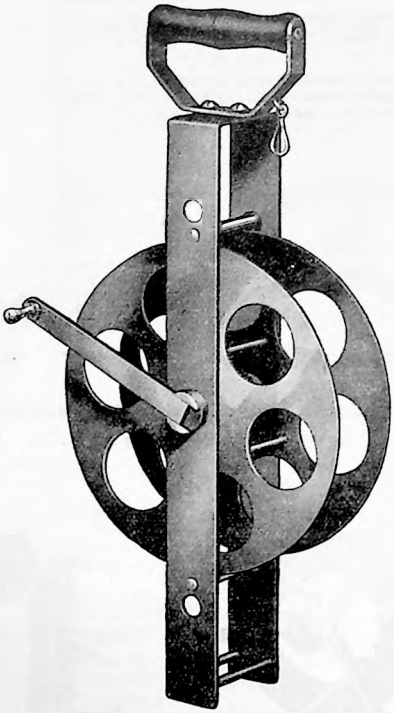
7650 B. folded

7650B. Folding Reel, brass, nickelplated, hardwood knob, for tapes 100 to 200 ft. long . . . . . each $

Please note that these prices are for REELS ONLY. The lines shown on some of the cuts of the reels are for better illustration.

When ordering reels separately, please state for which length of line and kind of graduation.

COLORADO STEEL REEL.



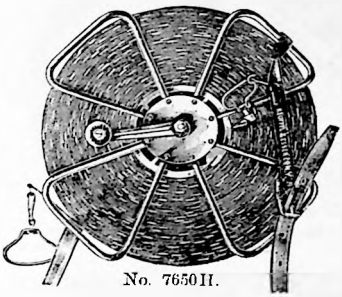
This reel is intended for steel tapes from 100 to 500 feet long, up to $\frac{5}{8}$ in. wide. It is substantially built, of steel throughout, with a hardwood supporting handle. For reeling the tape, there is a long folding handle which "locks" into an opening at either end of the frame, and thus prevents the tape from unwinding, when only a part of its length is required.

This is a sturdy reel, and meets a definite need.

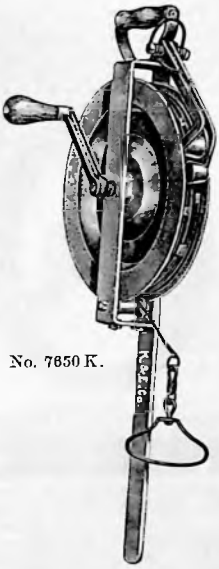
7650 G. Colorado Steel Reel, frame 17 in. long; drum 8 in. in diameter, 2 in. wide; long folding lock handle; for steel tapes 100 to 500 feet long, up to $\frac{5}{8}$ inch wide. . . . . each $

When ordering, please mention kind of tape, also width and length, for which the reel is intended.

K & E REELS.



No. 7650H.



No. 7650K.

7650H. K & E Improved Metal Reel, with strong shoulder strap, for lines from 300 to 500 feet, for $\frac{1}{8}$" lines only . . each $

Reel H is a heavy metal skeleton reel with large center and extra-long handle with large knob. It is very strongly and substantially built. The eight metal arms are so arranged that they preclude kinking of the line during winding and leave the wound line freely exposed to the air for rapid drying and cleaning.

7650K. Mine Reel, steel, 10 in. diameter, 24 in. over all with arm extended. Spooling controller for distributing the line evenly on the reel when winding. Large roller to mouth piece. Long stout steel crank with hardwood handle. Weight about 5 pounds. For lines from 300 to 500 feet . . . . . each $

This reel will be found very convenient for use in mines. It is of steel and very substantially built. The folding steel arm, when extended, supports the reel while winding the tape and is folded across the reel when not required.

Please note that these prices are for REELS ONLY. The lines shown on some of the cuts of the reels are for better illustration.

When ordering reels separately, please state for which length of line and kind of graduation.

EXCELSIOR BAND CHAINS.

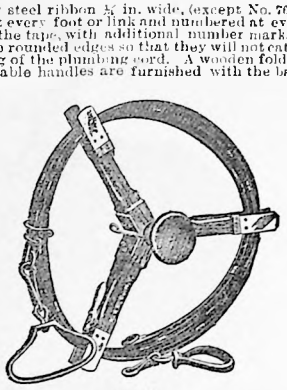
(Patented)

KECO Finish.

The Excelsior Band Chains are of heavy steel ribbon ⅜ in. wide, (except No. 7668.) They are graduated and marked by rivets at every foot or link and numbered at every 5 feet or 5 links on brass plates riveted to the tape, with additional number marks at every 10 feet or links. The number plates have rounded edges so that they will not catch, and they are notched to insure correct locating of the plumbing cord. A wooden folding reel like No. 7650-A, page 445 and two detachable handles are furnished with the band chain and are included in the price.



No. 7660 C.



7668.



Graduations of Patent Excelsior Band Chains Nos. 7660 to 7663.

7660.	Excelsior Band Chains, ¼ in. wide, with reel,										
			50	feet,	grad.	every	foot,	end	feet	to	10ths. each $
7660B.	do.	do.	100	"	"	"	"	"	"	"	"
7660C.	do.	do.	200	"	"	"	"	"	"	"	"
7660D.	do.	do.	300	"	"	"	"	"	"	"	"
7661C.	do.	do.	200	"	"	"	5	feet,	"	"	"
7661D.	do.	do.	300	"	"	"	"	"	"	"	"
7662.	do.	do.	50	"	"	"	foot,	end	feet	to	12ths "
7662B.	do.	do.	100	"	"	"	"	"	"	"	"
7662C.	do.	do.	200	"	"	"	"	"	"	"	"
7663C.	do.	do.	200	"	"	"	5	feet,	"	"	"
7663L.	do.	do.	66	"	"	"	link	(100	links)		"

For Nos. 7664 and 7666, see page 449.

For lines (without reels) see page 452.

EXCELSIOR RAILROAD BAND CHAIN.

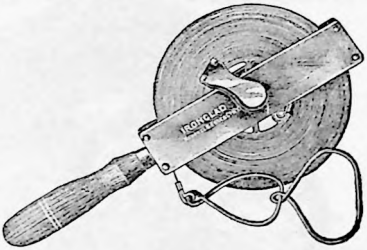


Graduations of Excelsior Railroad Band Chains No. 7668.

7668. Excelsior Band Chain, **EXTRA HEAVY**, for Railroad work, etc.. ⅜ in. wide, 100 feet, graduated every foot on brass sleeves, end feet to tenths, very thick steel band, two swiveling chain handles attached by strong spring hooks and solid rings: best quality and workmanship throughout; reel similar to Style 7650 A (page 445); a correct and very substantial Band Chain for rough work . . . . . each $

Any of the above band chains with one extra subdivided foot BEFORE zero, furnished to order without extra charge.

IRONCLAD BAND CHAINS.



No. 7664C.

IRONCLAD BAND CHAINS are of most substantial construction and very accurate. The line is of heavy steel ribbon, ¼ in. wide. The very practical reel consists of two strong steel plates, 1⅝ in. wide, carrying a large center (for quick and easy winding) with extra-long heavy folding brass handle. The width of the side plates prevents tangling of the line in reeling or unreeling. All metal parts of the reel are heavily nickelplated. The line, when reeled up, is exposed to the air, so that it will dry readily and free itself of adhering soil or dirt. Two large nickelplated handles for the line are furnished with each chain.

We recommend the **IRONCLAD BAND CHAINS** for their durability; they are practically indestructible.



Graduations of Ironclad Band Chains No. 7664.

IRONCLAD Band Chains, heavy black steel ribbon, ¼ inch wide, **KECO finish, etched** graduations at every foot, end feet to 10ths and 100ths. The graduations are etched in a manner which insures permanence in rough work. Reel and all mountings nickelplated; two large handles for the line.

7664B.	**IRONCLAD** Band Chain,	¼	in. wide, etched graduations,			100 ft.,	each	$
7664C.	do.	do.	do.	¼	"	"	do.	200 ft.,	"



Graduations of Ironclad Band Chains No. 7666.

Made in 3/16, 1/4 and 5/16 in. widths.

IRONCLAD BAND CHAINS, heavy steel ribbon, plated with white metal (to resist rust) and graduated and numbered at every foot on Babbitt metal, end feet to 10ths. Reel and all mountings nickelplated; two large handles for the line.

7666 B-3.	**IRONCLAD** Band Chain,	$\frac{3}{16}$	in. wide,	100 ft.	each	$
7666 B-4.	" " "	$\frac{1}{4}$	" "	100 "	"
7666 B-5.	" " "	$\frac{5}{16}$	" "	100 "	"
7666 C-3.	" " "	$\frac{3}{16}$	" "	200 "	"
7666 C-4.	" " "	$\frac{1}{4}$	" "	200 "	"
7666 C-5.	" " "	$\frac{5}{16}$	" "	200 "	"

Above band chains with one extra subdivided foot BEFORE zero, furnished to order without extra charge.

For Lines (without reels), see page 452.

DREADNAUGHT BAND CHAINS.

WITHOUT REELS.

STRONGER AND MORE ACCURATE THAN WIRE CHAINS; EASIER TO HANDLE; NEARLY INDESTRUCTIBLE.



No. 7669 B.

Dreadnaught Band Chains are plated with white metal, to resist rust, and are carefully graduated and plainly numbered on Babbitt metal. We furnish them with rawhide handles, but will furnish metal handles at the same price, if they are specified on the order.

Some engineers engaged on large construction work prefer to use band chains without reels, carrying them looped, either over the shoulder or in the hand in figure eight form.

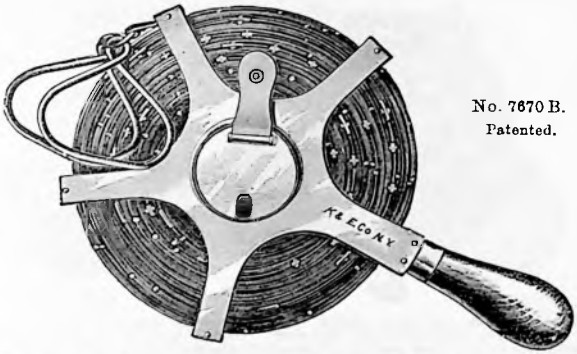


Graduations of Dreadnaught Band Chains.

7669 B-3.	Dreadnaught Band Chains (no reel) $\frac{3}{16}$ in. wide, plated white, graduated and numbered on **Babbitt metal** at every foot, end feet graduated to 10ths,					100 feet			each $
7669 B-4.	do.	do.	do.	$\frac{1}{4}$	in. wide,	100	"	"	"
7669 B-5.	do.	do.	do.	$\frac{5}{16}$	" "	100	"	"	"
7669 C-3.	do.	do.	do.	$\frac{3}{16}$	" "	200	"	"	"
7669 C-4.	do.	do.	do.	$\frac{1}{4}$	" "	200	"	"	"
7669 C-5.	do.	do.	do.	$\frac{5}{16}$	" "	200	"	"	"
7669 D-3.	do.	do.	do.	$\frac{3}{16}$	" "	300	"	"	"
7669 D-4.	do.	do.	do.	$\frac{1}{4}$	" "	300	"	"	"
7669 D-5.	do.	do.	do.	$\frac{5}{16}$	" "	300	"	"	"
7669 B M.	Dreadnaught Band Chain (no reel) $\frac{1}{4}$ in. wide, plated white, graduated and numbered on **Babbitt metal** at every half meter, end meters to decimeters,					25 meters, each			₹
7669 C M.	do.	do.	do.	do.		50	"	"	

Above band chains with one extra subdivided foot BEFORE zero, furnished to order without extra charge.

CHAMPION BAND CHAINS.



No. 7670 B.
Patented.

Champion Band Chains are of superior quality heavy steel ribbon, ¼ in. wide. They are numbered at every 5 feet, with additional number marks at every 10 feet. The number plates have rounded edges so that they will not catch, and they are notched to insure correct locating of the plumbing line. Nos. 7670 and 7671 are graduated and marked by rivets at every foot or link; the end feet are subdivided into 10ths. The reel is of stout metal, nickelplated, with polished wooden handle, two nickelplated handles and two rawhide handles for the line. The 100-foot band chain complete, weighs about 2 pounds and measures about 6¾ inches across. The "Champion" is a substantial and reliable band chain of light weight, strong enough for rough work and easy to wind and unwind. As the whole tape is exposed to the air while on the reel, it is easily dried and kept clean.



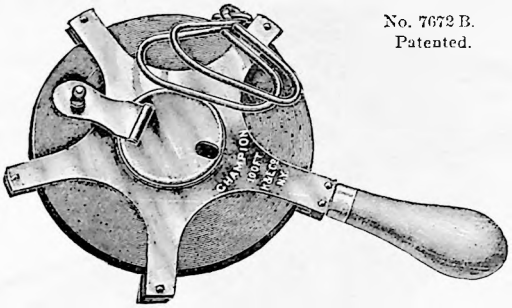
Graduations of Champion Band Chains Nos. 7670-7671.

7670 B	Champion Band Chain, ¼ in. wide, superior quality, heavy blued steel ribbon,				100 feet . . .	each	$
7670 C.	do.	do.	do.	do.	200 " . . .	"	
7670 D.	do.	do.	do.	do.	300 " . . .	"	
7670 L.	do.	do.	do.	do.	66 " (100 links)	"	
7670 B M.	Champion Band Chain, like No. 7670, but				25 Meters . .	"	
7670 C M.	do.	do.	"	"	7670, but 50 " . .	"	
7671 B.	Champion Band Chain, like No. 7670, but plated with white metal, to resist rust,				100 feet	each	$
7671 C.	do.	do.	do.	do.	200 "	"	
7671 D.	do.	do.	do.	do.	300 "	"	
7671 L.	do.	do.	do.	do.	66 " (100 links)	"	
7671 B M.	Champion Band Chain, like No. 7671 but				25 Meters	"	
7671 C M.	do.	do.	"	"	7671 " 50 "	"	

Above band chains with one extra subdivided foot BEFORE zero, furnished to order without extra charge.

For lines (without reels), see page 452.

CHAMPION BAND CHAINS.



No. 7672 B.
Patented.

Champion Band Chains No. 7672 are like No. 7670 but with etched graduations at every foot or link, end feet to 1/10ths and 1/100ths. The graduations are etched in a new manner, which insures their durability in rough work. They have the KECO Finish.



Graduations of No. 7672.

7672 B.	Champion Band Chain, ¼ in. wide,	etched,	100 feet	. .	each	$
7672 C.	do.	do.	do.	200 "	. .	"
7672 D.	do.	do.	do.	300 "	. .	"
7672 L.	do.	do.	do.	66	"(100 links)	"



Champion Band Chains, No. 7674, are plated with white metal (to resist rust) and are graduated and numbered at every foot on Babbitt Metal. They are well adapted for use in mines, as no water or moisture can enter between the Babbitt metal and the band to corrode the tape. On rough ground like stone or gravel, the graduations are less liable to injury than rivets or plates.

7674 B.	Champion Band Chain, ¼ in. wide graduated on Babbitt metal,				100 feet	. . . each $
7674 C.	do.	do.	do.	do.	200 "	. . . "
7674 D.	do.	do.	do.	do.	300 "	. . . "
7674 B M.	Champion Band Chain, like No. 7674B,			but	25 Meters,	"
7674 C M.	do.	do.	do.	do.	" 50	" "

LINES FOR BAND CHAINS.

(Without Reels.)

Lines ¼ in. wide, for Champion or Ironclad Band Chains, graduated by rivets, etched, or on Babbit metal.

66	**100**	**200**	**300** feet	**25**	**50** meters
each $				each $	

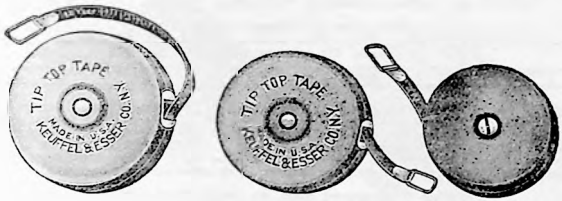
In ordering lines only, please state catalogue number of Band Chain for which line is required.

Above band chains with one extra subdivided foot BEFORE zero, furnished to order without extra charge.

TIP TOP POCKET TAPES.

KECO Finish.

Nickelplated Cases.



No. 7714 TF (front) 7711 (front) 7710 (back)

STEEL POCKET TAPES. SPRING WINDING.

TIP TOP Steel Pocket Tapes, ¼ in. wide, nickelplated case, spring winding, with stop at center.

Length in inches,	36	60	72	96
Inches to 16ths (one side) . . . each $	No. 7710 T	7711 T	7712 T	7713 T

No 7713 TF. Feet to Inches in 16ths (one side) . . Length 8 feet each $
No. 7714 TF. " " " " " " " " 12 " "

Length in feet,	3	5	6	8	12
Feet to 100ths . . . (one side). each $	No. 7710 D	7711 D	7712 D	7713 D	7714 D

Length in Meters,	1	1½	2	2½
Inches to 16ths, other side millimeters, each $	No. 7710 TM	7711 TM	7712 TM	7713 TM

Length in Meters.	3½
Feet to Inches to 16ths, other side to millimeters, each $	No. 7714 TFM

Tip Top Steel Pocket Tapes with scale. Length 60 inches.

No. 7711-4. Inches to 16ths, other side Scale ¼ in. to the foot, each $
No. 7711-8. " " " other side Scale ⅛ in. to the foot, "

LINEN POCKET TAPES.

TIP TOP Linen Pocket Tapes, ¼ in. wide, nickelplated case, spring winding, with stop at center.

Length in inches,	36	60	72	96
Inches to 16ths (one side) . . . each $	No. 7720 T	7721 T	7722 T	7723 T

No. 7723 TF. Feet to inches in 16ths (one side). Length 8 feet. each $

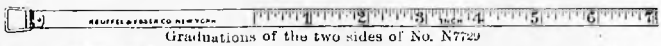
THE LENGTH OF THESE TAPES IS MARKED ON THE LINE BEFORE THE ZERO POINT.

K & E STEEL TAPES.

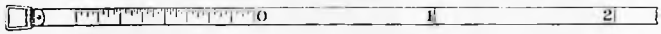
KECO Finish.

For reading diameter opposite circumference (π Tapes.)

N7729. **K & E** Steel Pocket Tape, 1/4 in. wide, Tip Top, nickel-plated case, spring winding, with stop, **12 feet** . . . . each $



Graduations of the two sides of No. N7729



This tape is graduated on one side in feet, inches and sixteenths of inches; on the other side spaces equal to 3.1416 inches are marked off and numbered 0, 1, 2, etc., the one before zero being subdivided into 64 equal parts. If the tape is passed around a circular object, say a column, the "circumference" side will show the correct number of inches and fraction of inch (to 64ths in.) of the diameter. (see cut). There are many cases in which such a tape is useful and certainly handier than a pair of large calipers.

For other Circumference Tapes, see pages 424 and 429.

K & E MECHANIC'S STEEL TAPES.



Please order by number.

K & E Mechanic's Steel Tapes, KECO finish, $\frac{3}{8}$ in. wide, nickelplated metal case, large center with long folding handle, graduations begin on the line.

Length in feet,	10	15	20
Feet in inches, (to 16ths inches). . . . each $	No. 7760½	7761½	7762

The **K & E** Mechanic's Steel Tapes are of practical construction. As they are very accurate, as compared with a woven tape, finely subdivided and of moderate cost, they will often be preferred to the less reliable woven tapes or folding rules. They will stand rough handling and will not be injured by knocking about in a tool chest.

SOUNDING ATTACHMENT FOR TAPES.



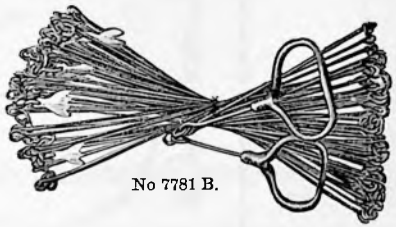
No. 7769.

7769. Sounding Attachment for Tapes . . . . . each $

This attachment for measuring the depth of oil in tanks, etc., consists of a heavy conical weight with 3 short feet, attached by a ring to a short piece of tape line which ends in a stout snap hook. It can be used with any tape with graduations beginning at end of ring; it is only necessary to add 1 foot to the reading of the tape to obtain correct measurement, as the attachment is exactly one foot long.

If the Sounding Attachment and the tape are ordered together, we can furnish the tape to read actual measurement, if so desired.

MEASURING CHAINS.



No 7781 B.

STEEL, U. S. STANDARD.

7780 A.	Steel, W. G.	12,	Brass Handles,	oval rings,	50 feet	. . . .	each	$
7780 B.	do.	"	"	12,	"	"	"	"	100	"	. . . .	"
7780 C.	do.	"	"	12,	"	"	"	"	33	"	(50 Links)	"
7780 D.	do.	"	"	12,	"	"	"	"	66	"	(100 Links)	"
7781 A.	do.	"	"	12,	"	" brazed links and rings,				50 feet		"
7781 B.	do.	"	"	12,	"	"	"	"	"	"	100	"	"
7781 C.	do.	"	"	12,	"	"	"	"	"	"	33	"	(50 Links)
7781 D.	do.	"	"	12,	"	"	"	"	"	"	66	"	(100 Links)

Chain No. 7781 B has a spring hook (snap) at 50 feet, so that it can be separated there and the handle attached for using it as a 50-foot chain.

STEEL, METER AND VARA.

7782 A.	Steel, W. G.	12,	Brass Handles,	oval rings,	10 meters	. .	each	$
7782 C.	do.	"	"	12,	"	"	"	"	20	"	. . .	"
7783 A.	do.	"	"	12,	"	" brazed links and rings,				10 meters		"
7783 C.	do.	"	"	12,	"	"	"	"	"	"	20	"	"
7783 D.	do.	"	"	12,	"	"	"	"	"	"	25	"	"
7785 A.	do.	"	"	12,	"	" brazed links and rings,				10 Varas		"
7785 B.	do.	"	"	12,	"	"	"	"	"	"	20	"	"

The Vara Chains are in Mexican Varas (838 mm.). Chains in Varas of other Standards furnished to order.

IRON, U. S. STANDARD.

7786 A.	Iron, W. G.	8,	Brass Handles,	2 round rings,	50 feet	. . .	each	$
7786 B.	do.	"	"	8,	"	"	2	"	"	100	"	. . .	"
7786 C.	do.	"	"	8,	"	"	2	"	"	33	"	(50 Links)	"
7786 D.	do.	"	"	8,	"	"	2	"	"	66	"	(100 Links)	"

ARROWS.



No. 7809.



7810.



7813.



7825.

7809. Wrought Steel Arrows. Red Enameled. 15 in., set of 11 $
Arrows No. 7809 are of tempered wrought steel, extra heavy, and useful on hard ground.

7810. Steel Arrows, W. G. 6, nickelplated 14 in., set of 11 $
7811. do. do. " " 9, do. 14 " " " 11
7812. do. do. " " 9, red enameled 12 " " " 11
7813. do. do. " " 11, nickelplated 12 " " " 11
7815. Iron do. " " 9, ... 14 " " " 11
7818. Steel Arrows, W. G. 6, bright, 14 in., with white enameled disc 2½ in. diam., with red figures 1 to 11 " " 11
7819. Canvas Carrying Case for No. 7818, with shoulder strap . . each
7820. Leather Quiver with belt loop for set of 11 arrows. . . . . "
7825. Spring Steel Carrying Ring for arrows . . . . . "
When ordering No. 7820, state for which catalogue number of arrows.

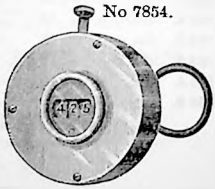
TALLYING MACHINES.



No. 7846.



7847.

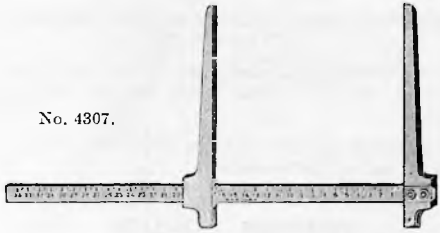


No 7854.

7846. Tallying Machine, for keeping count by pressing on a knob, nickelplated watch case, porcelain dial, 3 numbered dials, registers to 1000, with lever for setting hands to zero. . each $
7847. Tallying Machine, like No. 7846, but with 4 numbered dials, registers to 10,000. . . . . each
7854. Tallying Machine, for keeping count by pressing on a knob, nickelplated, registers to 999, arranged to set back to zero. each
7854X. Tallying Machine, like No. 7854 but registering to 9999, . . each $

INSTRUMENTS FOR FOREST WORK.

TREE CALIPERS.



No. 4307.

4305.	Tree Caliper, fine quality, hardwood,					18	inch,	1	clamp	nut,	each	$
4307.	"	"	"	"	"	34	"	2	"	"	"	
4309.	"	"	"	"	"	50	"	2	"	"	"	

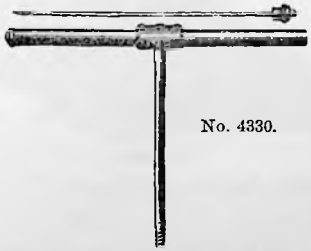
These calipers are of light-colored hardwood, best workmanship, finely finished, beam graduated to 10ths inches and plainly numbered. The arms are detachable for convenience in transportation. The stationary arm is held by brass clamp nuts with lock nut. The eye of the sliding arm is brass-lined all around.



Tree Tape No. 7262 P. reading circumference and diameter, with jointed anchor peg for attaching to tree,
see page 424.

For other Tree Tapes, see pages 429 and 454.

SWEDISH INCREMENT BORERS.



No. 4330.

4330.	Increment	Borer,	length	of	bore	2½	in.	. . . . .			each	$
4331.	do.	do.	"	"	"	4	"	. . . . .			"	
4332.	do.	do.	"	"	"	6	"	. . . . .			"	
4333.	do	do.	"	"	"	8	"	. . . . .			"	
4334.	do.	do.	"	"	"	10	"	. . . . .			"	
4335.	do.	do.	"	"	"	11¾	"	. . . . .			"	

These Swedish Increment Borers are the latest and most approved type and are of the finest quality. The steel borer proper and the steel plug extractor can be stored in the tubular nickelplated metal handle. They work rapidly and surely in both soft and hard woods and make perfect cylinders.

STEM ANALYSIS RULES.



No. 4348.

4347. Stem Analysis Rules, 12 in., brass, nickelplated, engine divided, one edge to 10ths inches; the other to 20ths inches . . . . . each $

4348. Stem Analysis Rules, 12 in., like No. 4347 but with centering pin on the 10ths inches edge . . . . . "

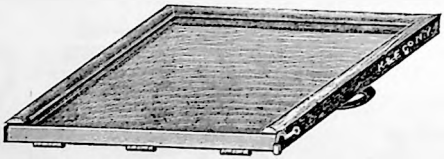
TIMBER SCRIBE.



No. 4352.

4352. Timber Scribe, wooden handle, 6½ in. . . . . each $

TALLY SHEET HOLDERS.



No. 4362.

4360. Tally Sheet Holder, for tally sheets 7×10 in . . . . . each $

4362. do. do. " " " 10×12 " . . . . . "

The frames are of hardwood and provided with strap handle. The hinged side is of brass and is held by a hook.

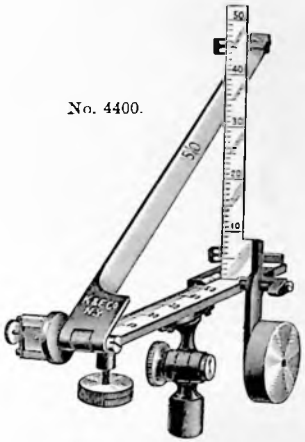


No. 7854, Tallying Machine, nickelplated, for keeping count by pressing on a knob, registers to 999, sets back to zero . . . . each $

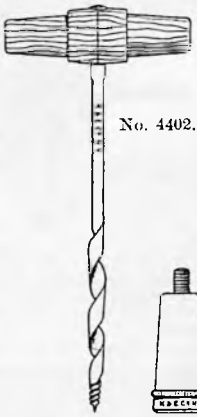
(Repeated from page 456.)

HYPSOMETERS.

No. 4400.



No. 4402.



No. 4404.

4400. Hypsometer (after Klaussner), brass, graduated surfaces silvered, in wooden box 8 × 2¾ × 2⅜ inches . . . . . each $

4402. Gimlet Support, for attaching hypsometer to a tree or post, hard wood cross piece (handle) . . . . . "

4404. Brass Socket threaded to fit the jointed ferrule and fitting the handle of the gimlet support, or a staffhead . . . "

This Hypsometer offers an advantage over most others in that the total height of the tree or other object can be read direct from one scale without the necessity of adding the readings above and below the observer's level. The weighted altitude scale is much steadier in the wind than a plumbbob.

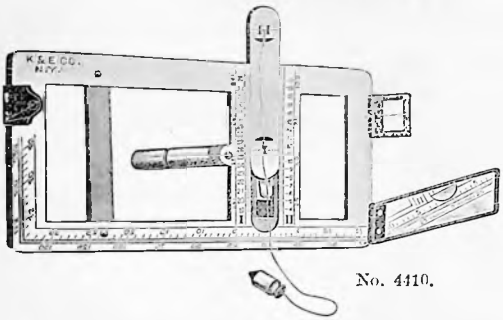
The instrument consists of a base rule 6 in. long, a hinged sighting rule and an altitude scale held vertical by a weight. The base rule is graduated up to 60 equal parts, each part divided into halves, forming the distance scale. It carries a slide with index line, to which the weighted altitude scale is attached. The altitude scale is graduated to 50 equal parts, each part divided into halves. The graduations may be read as yards, meters, feet or n any other unit, depending on the unit adopted in measuring the base line (from observer to object). The sighting rule is hinged to the near end of the base rule, and like the base rule, has a hair-line sight at its further end. At the joint of these two rules is a revolvable peep sight, which can be directed to either of the two hairlines by turning a milled disk. The instrument has a jointed ferrule with clamp screw which is threaded to fit the regular photographer's tripod screw.

The slide of the altitude scale is set on the distance scale to correspond to the measured base line. After sighting the base of the object along the base rule, the sighting rule is raised by means of a high pitch thumbscrew, until its hairline cuts the top of the object, when the total height is read from the altitude scale.

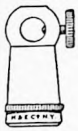
It is particularly adapted to cases where necessity of haste or roughness of country make the use of a tripod impracticable.

For Jacob staff and Tripods, see page 352.

HYPSOMETERS.



No. 4410.



4411.

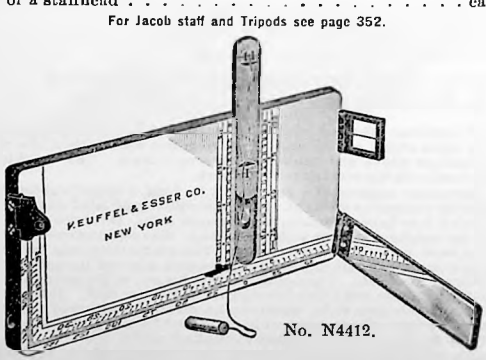
4410. Hypsometer 3½ x 7 in. (after Faustmann), brass, graduated surface silvered, hinged mirror mounted in aluminum, folding sights, folding swiveling handle. In cloth covered pouch 3½ × 7½ × ⅝ in. with cover flap. With Directions . . . . . each $

4410S. Sole Leather Pouch for No. 4410, ... extra "

This Hypsometer is provided with two scales: the scale of heights on the lower edge of the instrument, and the scale of distances on the two edges of the groove in which the slide moves. The slide carries the plumbbob thread and has two reading lines marked I and II, corresponding to the two scales of distances also marked I and II. It is held in place by a spring. The plumbbob is stored in a small tube at the back of the frame. The peep hole and hairline sights and mirror (5¾ x ¾ in.) are hinged to fold down.

4411. Brass Ferrule, to fit gimlet support, (No. 4402, p. 459). or a staffhead . . . . . each $

For Jacob staff and Tripods see page 352.

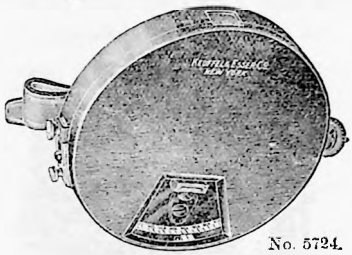


No. N4412.

N4412. Hypsometer (after Faustmann), like No. 4410, but of polished hardwood, graduations on wood protective coating, hinged mirror mounted in aluminum, folding sights. In cloth covered pouch 3½ × 7½ × ⅝ in. with cover flap. With Directions, ... each $

See also Military Clinometer, page 365.

HYPSOMETER AND GRADEMETER.



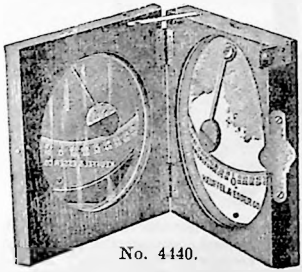
No. 5724.

5724. Hypsometer and Grademeter as manufactured by us for the U. S. Forest Service; bronzed brass case $3\frac{3}{8} \times \frac{3}{4}$ in., sensitive gravity (pendulum) clinometer; graduated to per cent of angle, from 0 to 50% for depression and from 0 to 200% for elevation. The spring stop is released by pressing knob; sliding lock for spring stop. Leather strap handle; with directions . . . . . each $

The line of sight passes through the diameter of the box, from a peep sight in one side to a small glazed window in the opposite side. A segment of the cover, closed by transparent celluloid, admits light to the graduations, which are seen simultaneously with the sighted object.

This instrument was designed and patented by Mr. F. G. Plummer of the U. S. Forest Service.

CLINOMETERS FOR MEASURING HEIGHTS.



No. 4440.

No. 4442.

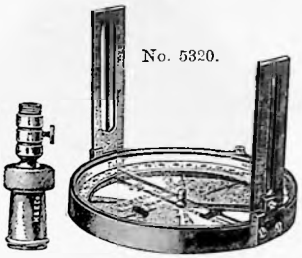


4440. Clinometer, mahogany frame with hinged cover, $4\frac{1}{4} \times 4\frac{1}{4} \times 1$ in., silvered metal dial with cover glass. Graduated to per cent of angle to 100% each way (by 2%), numbered at each 10%, with a second row of reversed numbers for reading in the mirror in the lid while sighting. The upper edge has a peep sight and sighting pin, the lower serves as fiducial edge. . . . . each $

4442. Clinometer, mahogany frame $3 \times 3 \times \frac{1}{2}$ in., silvered metal dial with cover glass. Graduated to per cent of angle to 100% each way (by 2%), numbered at each 10%. Either the top or bottom of the frame may be used as fiducial edge and for sighting . . . . . "

In Nos. 4440 and 4442 the pendulum is held by a spring, (except when released by pressing a button on the right side of the frame,) so that its observed position can be fixed and read on the scale after sighting.

TIMBER CRUISER COMPASS.

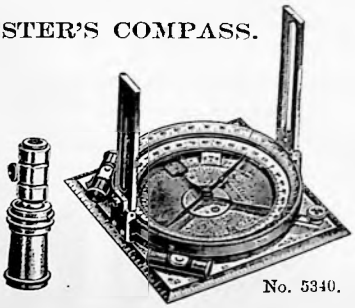


No. 5320.

5320. Timber Cruiser Compass, with folding sights, graduated on raised ring to degrees, RADIAL LINES AT HALF-QUADRANTS, variation plate, two spirit levels, Ball joint and Socket (No. 5348-2 p. 351) for Jacob staff mounting, needle about 3½ in., in polished mahogany Case, each $
Sewed leather Sling Case in place of mahogany case . . extra "

(This item is repeated from page 349.)

FORESTER'S COMPASS.



No. 5340.

5340. Forester's Compass, as made by us for the U. S. Forest Service, aluminum, folding brass sights. Raised compass ring graduated to degrees, variation plate reading by vernier to 5 minutes. Improved needle about 2⅝ inches, with stop, jeweled centre. Beveled ring on compass box, graduated to degrees, numbered in quadrants, sighting mark at each quadrant, with knurled edge for revolving in azimuth. Pendulum clinometer graduated to degrees for 90 degrees in each direction. Base 4x4 in., beveled edges; two edges graduated as a protractor, one edge graduated to 8ths inches representing chains on scale of 1 inch to one mile, the other edge graduated to 10ths inches. Two spirit levels on the base. A township diagram on under side of base. Instrument complete with ball joint and socket for Jacob Staff mounting; in sewed leather Case with shoulder strap . . . . . each $

The Forester's Compass is light and portable. The variation of the needle is set off by revolving the raised compass ring by means of a slotted screw projecting through the side of the compass box, which serves also as set-screw. The beveled ring can be used for turning right angles or for sighting vertical angles by placing the edge of the base on a level surface.

This style of Compass is also known as Geologist's Compass and also is used largely in topographical work. It is listed as such on page 351.

BOOKS ON THE SLIDE RULE.

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SURVEYING INSTRUMENTS MEASURING TAPES

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